

CENTRAL IOWA POWER COOPERATIVE

2017 INTEGRATED RESOURCE PLAN

For Submittal to WAPA

MARCH 2017



2017 Integrated Resource Plan

For Submittal to WAPA

Central Iowa Power Cooperative

Des Moines, Iowa

Respectfully submitted,

A handwritten signature in blue ink, reading "Dusky Terry", is written over a horizontal line.

Dusky Terry
Vice President of Planning & Growth Strategies

CENTRAL IOWA POWER COOPERATIVE
2600 Grand Avenue, Ste. 300
Des Moines, IA 50312
(515) 323-3195
www.cipco.net

Central Iowa Power Cooperative

2017 Integrated Resource Plan

Table of Contents

Executive Summary.....	i
Chapter 1: Background and Objectives.....	1
About CIPCO.....	1
CIPCO IRP Objectives.....	2
Organization of Report	3
Cross-Reference with WAPA IRP Checklist	3
Additional Documents and Resources	6
Chapter 2: Current Resources.....	7
Demand-Side Resources	7
Supply-Side Resources	13
CIPCO-Owned Generation	13
Long-Term Power Purchase Agreements	15
Transmission Resources and Facilities.....	17
Chapter 3: Resource Needs.....	19
Load Forecast.....	19
Residential Class Forecasts	20
Commercial and Industrial Class Forecasts.....	20
Other Retail Class Forecasts.....	20
Total Sales to Distribution Cooperatives.....	20
SIMECA Forecasts.....	21
Total CIPCO Energy Requirements and Peak Demands.....	21
Changes to Existing Resources.....	23
Other Drivers of Resource Needs	23
Resource Needs Summary	24
Chapter 4: Demand-Side Resource Options	26
DSM Objectives.....	26
Evaluation Criteria.....	26
Five-Year DSM Plan	29
Long-Term DSM Plan	31
Verification and Durability	33
Chapter 5: Supply-Side Resource Options	34
New Generation Options	34
New Coal Plant Options	36
New Nuclear Plant Options.....	36
New Natural Gas Plant Options	37
Cogeneration and District Heating and Cooling Options.....	39
New Renewable Power Options	40

Power Purchase Options.....	41
Transmission Options.....	43
Chapter 6: Preferred Resource Plan	46
Integrated Resource Evaluation.....	46
Avoided Costs.....	46
Selected Demand-Side Resources.....	47
Selected Supply-Side Resources	47
Increase Wind and Solar Power Purchases.....	48
Add Peaking Capacity with Load Following Capability.....	48
Continue Limited PPAs.....	49
Power Supply Summary	49
Load and Capability.....	53
Environmental Assessment.....	55
Plan Meets Key Objectives.....	58
Providing Adequate and Reliable Service	58
Maintaining Competitive Costs.....	58
Minimizing Environmental Impacts and Risks	59
Fulfilling CIPCO’s Mission	59
Uncertainty and Contingency Management.....	60
Load Growth Changes	61
Fuel Price Level Changes.....	61
Environmental Regulation Changes	62
DSM Changes	62
Chapter 7: Action Plan	63
Action Items	63
Measurement and Verification	64
Chapter 8: Member and Public Input	65
Member-System Input	65
CIPCO Member Cooperatives and Local Contractors - Momentum Is Building	66
General Public Input	66
Chapter 9: Approval.....	67

CIPCO Member Systems

CIPCO’s 12 member rural electric cooperatives are:

- | | |
|--|--|
| Clarke Electric Cooperative (IA-079) | Linn County Rural Electric Cooperative (IA-053) |
| Consumers Energy Cooperative (IA-007) | Maquoketa Valley Electric Cooperative (IA-034) |
| East-Central Iowa Electric Cooperative (IA-095) | Midland Power Cooperative (IA-093; IA-43 Greene) |
| Eastern Iowa Light & Power Cooperative (IA-009) | Pella Cooperative Electric Association (IA-040) |
| Farmers Electric Cooperative (IA-073) ⁺ | Southwest Iowa Rural Electric Cooperative (IA-100)** |
| Guthrie County Rural Electric Cooperative (IA-021) | T.I.P. Rural Electric Cooperative (IA-056) |

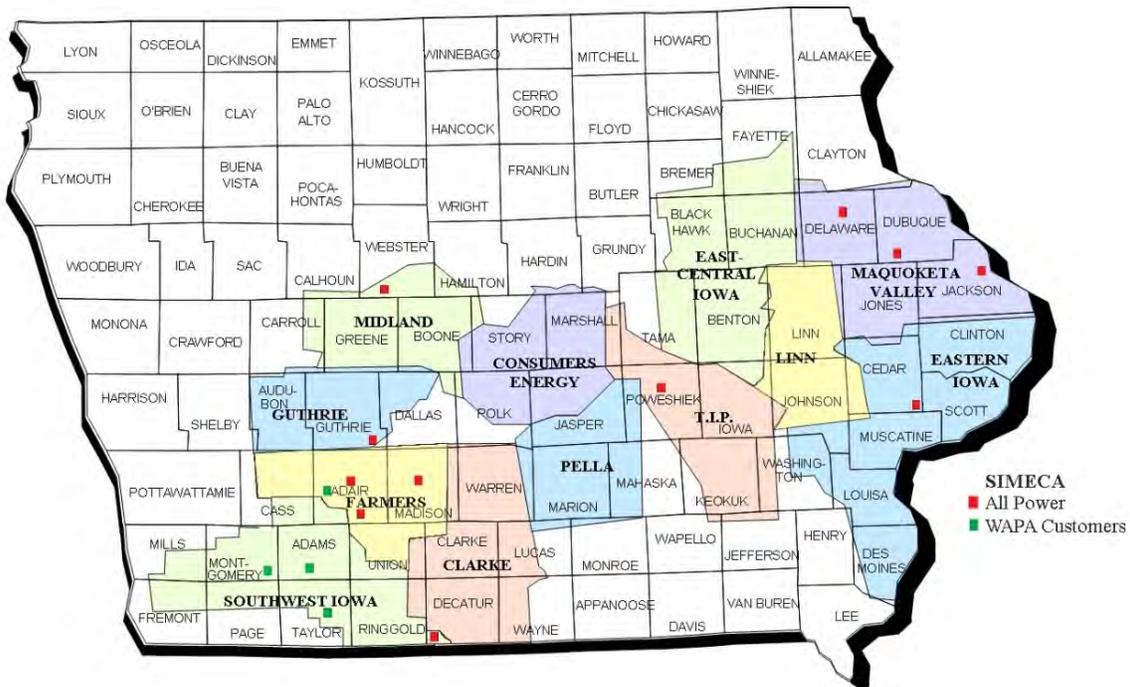
The South Iowa Municipal Electric Cooperative Association (SIMECA) is a federation of municipal utilities and a CIPCO member system. SIMECA’s 15 municipal member systems are:

- | | | | |
|----------|-------------------------|-----------|--------------------------|
| Bellevue | Earlville | Orient | Corning* |
| Brooklyn | Gowrie | Stuart | Fontanelle* ⁺ |
| Cascade | Greenfield ⁺ | Winterset | Lenox* |
| Durant | Lamoni | | Villisca* |

* A “wheeled” SIMECA member also receiving power from WAPA

** Southwest Iowa REC provides power to the City of Stanton beyond its WAPA allocation

⁺ Purchases a portion of their power through separate wind contracts



Executive Summary

The Central Iowa Power Cooperative (CIPCO) 2017 Integrated Resource Plan (IRP) is being submitted to the Western Area Power Administration (WAPA) in accordance with the requirements of the Energy Policy Act of 1992. The IRP is designed to evaluate CIPCO's future resource needs and to comprehensively and consistently determine the preferred mix of demand- and supply-side resources to meet its needs over the 2017 to 2031 period. The IRP objectives, process, methodologies, and results are documented in this report.

CIPCO's IRP provides a strategic roadmap to guide ongoing management decisions over a long-term planning horizon while maintaining the flexibility to adapt to ever-changing business, operational, and regulatory environments. The IRP strategy balances multiple objectives reflecting CIPCO's responsibilities to maintain competitive costs, optimize its use of resources, acquire new resources to meet future needs, maintain environmental responsibility, serve members' needs and manage an array of current and potential future risks. While the preferred resource strategy included in this IRP is intended to meet those objectives, it is recognized that the future may develop differently than is currently envisioned and will require adaptation within CIPCO's ongoing planning processes. Therefore, the IRP's preferred plan portrays CIPCO's preferred resource strategy while incorporating flexibility and risk management to allow it to successfully meet the IRP's key objectives under a range of uncertain future outcomes.

CIPCO's member systems provide power to consumers located in 58 of Iowa's 99 counties in an area stretching 300 miles diagonally from northeast to southwest Iowa. The service territory borders the Mississippi River and extends westward into southwestern Iowa, approaching the Nebraska border. The southern portion of the service territory borders Missouri and extends northward to Dubuque and near Waterloo. CIPCO's member systems serve suburban areas located around Iowa's largest cities including Ames, Des Moines, Cedar Rapids, Waterloo, Iowa City, Muscatine, Davenport and Dubuque.

CIPCO's existing resources include a robust set of Demand-Side Management (DSM) programs, numerous and diverse power supply resources, and a transmission system designed to reliably deliver power to end-use consumers. The distribution systems and a modest amount of consumer-owned generation contribute to the integrated system's available resources.

A key component of the CIPCO system's resource strategy is its robust set of programs that promote energy efficiency, encourage conservation, and reduce annual peak demand. CIPCO and its member systems offer a wide variety of cost-effective DSM programs to residential, commercial, industrial, and agricultural consumers. Many of these programs have been offered for decades, although several new programs have been added and others changed or adapted in recent years due to changes in technologies, regulations, or market conditions. In addition, interruptible contracts are available to medium- and large-sized businesses. The combination of these programs helps reduce the total energy use of end-use consumers, reduce the system's load during times of peak demand, and provide load flexibility to enhance reliability and reduce costs.

CIPCO's power supply resources include ownership of part or all of nine generation units at four stations, long-term power purchase agreements with wind, hydro, solar, and landfill gas energy suppliers, generation resources owned by municipal electric utilities within the CIPCO system, short-term and long-term power supply contracts, and day-ahead and spot market purchases from the wholesale market coordinated by the Midcontinent Independent System Operator (MISO).

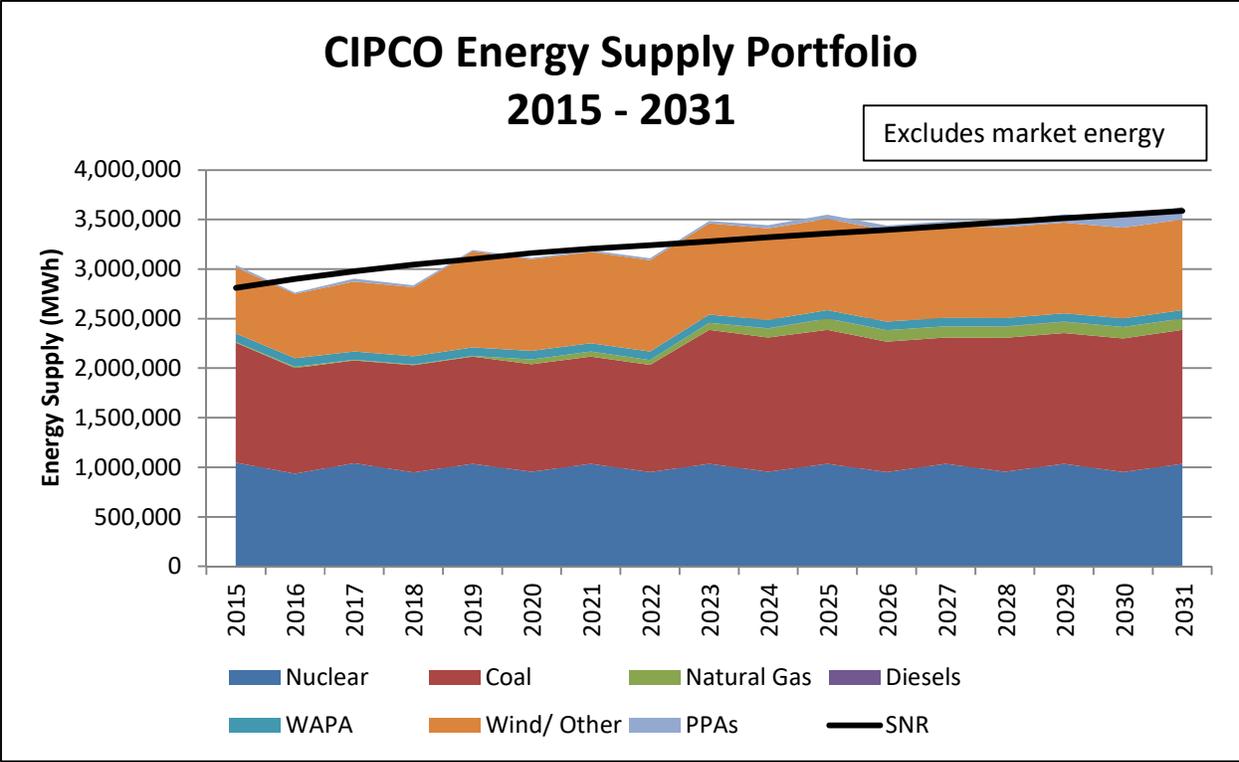
CIPCO's transmission resources include approximately 1,900 miles of transmission and sub-transmission lines, including 1,282 miles of lines 69 kV and above and 613 miles of sub-transmission 34 kV lines. Power is delivered to end-use consumers through approximately 300 distribution points and an integrated transmission network shared with Alliant Energy/Interstate Power & Light (IPL), which is owned and operated by ITC Midwest.

Future power supply resource needs are determined by load growth beyond what is met with cost-effective DSM and changes to existing power supply resources. Load growth on the CIPCO system is expected to occur at an average annual rate of 1.3 percent over the 15-year planning horizon used for this IRP, including the impacts of CIPCO's DSM resources. In addition to load growth, it is possible that selected existing generation units may be retired over the IRP horizon or that selected long-term power purchase contracts will not be renewed. The IRP process evaluates available demand and supply-side resources on an integrated and consistent basis to determine the preferred resource mix to meet the CIPCO system's future power supply needs.

Based on the IRP analyses, CIPCO's future system needs will be met primarily with the following preferred set of resources:

- Over 30 DSM programs offered to residential, commercial, industrial, and agricultural consumers.
- Interruptible contracts for medium and large businesses. These contracts have the ability to provide 12 MW of savings in 2017, increasing to a projected 26 MW by 2031.
- Add a new 6.0 MW_{AC} solar generation contract in 2017.
- Additional long-term wind power generation contracts beginning in 2019.
- Add small gas-fired generation units starting in 2020 and continuing into future years as needed.

The following graph illustrates CIPCO's future power supply resources required to meet the energy needs of its member-systems beyond what is met through cost-effective DSM programs.



The preferred set of new resources meets future power supply needs in an adequate and reliable fashion, and also provides the following benefits:

- CIPCO’s well-established DSM programs provide consumer benefits beyond energy savings including (but not limited to) increased home comfort, reduced use of water and other resources, increased home values, and increased environmental awareness.
- CIPCO’s ongoing commitment to wind, hydro, solar, and biomass power helps mitigate risks from future fossil fuel price increases and environmental regulation.
- CIPCO’s acquisitions of wind power support job growth in rural Iowa and provide economic benefits to Iowa farmers, including consumers of its member-systems.
- CIPCO’s acquisition of solar power at multiple Iowa locations supports local construction and maintenance jobs.
- CIPCO’s planned investments in small gas-fired generation units will continue to diversify its fuel supply mix while providing local reliability and system support for intermittent generation resources.
- CIPCO’s selected resource mix is consistent with its mission as a consumer-owned utility and the expressed preferences of its member-systems.
- The reduction in emissions intensity inherent in the IRP is in the public interest as it will provide benefits beyond the immediate CIPCO system.

The preferred resource mix identified in this IRP process helps CIPCO meet its key IRP objectives, including:

- Providing for the energy service needs of its members in a safe, reliable and economic manner;
- Reducing and managing adverse environmental effects;
- Maintaining a diverse and flexible set of resource commitments;
- Managing fuel price, wholesale market, and environmental risks;
- Providing documentation of CIPCO's IRP efforts for submittal to WAPA; and
- Ensuring that CIPCO's overall system cost remains within competitive boundaries.

This IRP is a collaborative effort involving input from CIPCO staff, its member system managers, Board of Directors representing its member systems, member-consumers of CIPCO's member systems, the general public, and third-party contributors. Collaboration among these parties has helped ensure that the preferred resource plan will be beneficial to CIPCO's member-systems and their member-consumers.

This report provides detailed descriptions of the IRP process, methodologies, analyses, and results.

Chapter 1: Background and Objectives

About CIPCO

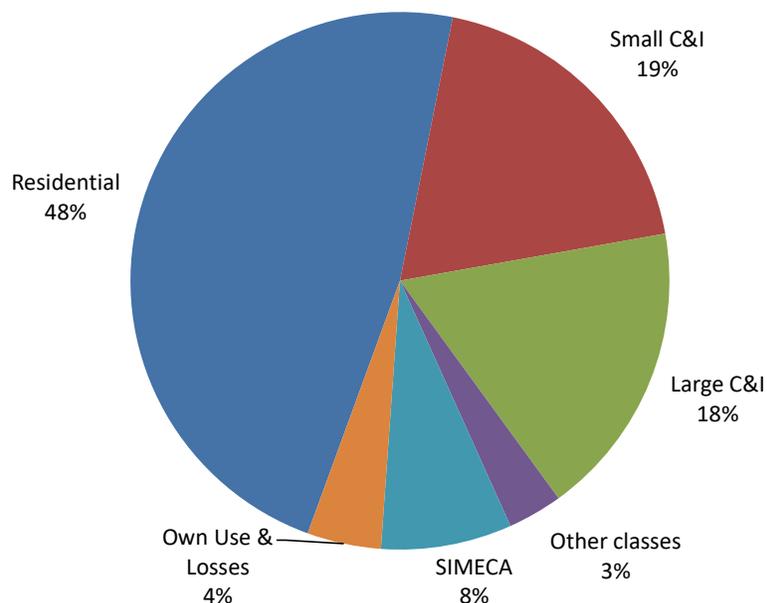
Central Iowa Power Cooperative (CIPCO) is Iowa's largest generation and transmission cooperative, supplying power across 58 of Iowa's 99 counties through its 13 member systems. CIPCO's service territory stretches 300 miles diagonally across the state from the Mississippi River on the east to Shenandoah in the southwest, covering nearly one-half the land area of Iowa including suburban areas surrounding most of Iowa's largest cities. Its member systems serve a population of approximately 340,000 rural and urban residents and over 13,000 business accounts. A list of CIPCO's member systems and a map of service territories were provided at the beginning of this report.

Although the consumer base of CIPCO's member systems was traditionally dominated by rural agricultural consumers, the member mix has become increasingly urban due to land development within commuting distance of Iowa's larger cities. The most recent CIPCO end-use survey indicates that only 21 percent of CIPCO's residential accounts now include a farm. This share was estimated to be 24 percent ten years ago, and greater than 50 percent in 1990.

The CIPCO system's 2015 total energy requirements were 2,809 GWh and its peak demand was 562 MW. Nearly one-half of CIPCO's 2015 energy requirements were retail sales to residential consumers of its 12 member rural distribution cooperatives, while over one-third were sales to commercial and industrial (C&I) consumers. Sales to SIMECA member systems comprised eight percent of total 2015 requirements. The composition of CIPCO's 2015 energy requirements is provided in Figure 1.

Figure 1

CIPCO 2015 Energy Requirements



CIPCO provides power to its member systems through a resource base consisting of:

- CIPCO-owned generation resources
- Bulk power purchases and interchange market power
- Municipal member-owned generation
- Pooling of generation and transmission resources with Alliant/IPL and ITC Midwest
- Power purchase agreements (including renewable¹ energy)
- Firm power from WAPA
- A portfolio of DSM programs

In addition, some member systems purchase wind power from third-party providers to meet a portion of their power requirements and some individual retail customers have on-site generation that supplies a portion of their energy needs.

CIPCO is financially sound and maintains an 'A' credit rating with Fitch Ratings with a stable outlook and an 'A' credit rating with Standards & Poor's with a stable outlook.

CIPCO IRP Objectives

The 2017 CIPCO Integrated Resource Plan (IRP) comprehensively evaluates CIPCO's current resource mix and its long-term resource needs, and determines the appropriate future resource mix to meet the needs of its member systems in a safe, reliable, and cost-effective and environmentally-responsible manner. The IRP process, analysis, and report help guide CIPCO's long-term resource planning strategy and are designed to meet the requirements of WAPA. This IRP updates information and plans provided in CIPCO's 2012 IRP and previous IRPs filed with, and approved by, WAPA.

The 2017 CIPCO IRP is being submitted to WAPA via Member-Based Association (MBA) status in accordance with the requirements of the Energy Policy Act of 1992 (EPAct), Public Law 102-486 Section 114, Title II – Integrated Resource Planning, and the Department of Energy, 10 CFR Part 905, Energy Planning and Management Program. This MBA filing represents the collective interests of the individual utilities served by CIPCO, including rural electric distribution cooperatives and municipal utilities served via SIMECA, and other municipal electric utilities served directly by CIPCO's rural electric cooperatives.

As a consumer-owned, non-profit cooperative, CIPCO has always been committed to providing safe, reliable, and economical service to its member consumers. Integrated resource planning is a key process by which CIPCO accomplishes this goal on behalf of its member systems. Through its assessment of a broad range of available supply- and demand-side resource options, the integrated resource planning process supports CIPCO's efforts to select the preferred mix of resources and programs to meet the needs of its membership. Actions taken as a result of integrated resource planning are designed to help CIPCO and its member systems improve the standard of living of their residential membership and the fiscal health of their commercial, industrial and farm consumers.

¹ All or some of the renewable energy credits associated with CIPCO's purchases may have been sold or may be sold in the future, to other parties, or may be used to comply with future regulatory requirements

CIPCO has established the following objectives for the 2017 IRP:

- Provide for the members’ energy service needs in a safe, reliable, and low-cost manner
- Reduce and manage adverse environmental effects
- Maintain diverse resource commitments that promote adequate flexibility to respond to uncertainties and changing market conditions
- Gain experience with, and an understanding of, new technologies to better serve and educate members as their wants and needs change
- Manage wholesale and retail market risks
- Retain balanced and diversified power supply and fuel portfolios
- Ensure that the overall system cost remains within competitive boundaries
- Provide clear and concise documentation of CIPCO’s IRP efforts to WAPA

Organization of Report

The remainder of this report includes detailed discussions of the process and analysis completed as part of this IRP. The general outline of the remainder of this report, along with the WAPA requirements satisfied in each section (in accordance with WAPA’s current IRP checklist), is provided as follows:

Ch. 2: Current Resources	IRP checklist: None
Ch. 3: Resource Needs	IRP checklist: #7, #19
Ch. 4: Demand-Side Resource Options	IRP checklist: #4, #5
Ch. 5: Supply-Side Resource Options	IRP checklist: #3
Ch. 6: Preferred Resource Plan	IRP checklist: #1, #2, #6, #8, #9, #13, #14
Ch. 7: Action Plan	IRP checklist: #10, #11, #12, #20, #21
Ch. 8: Member and Public Input	IRP checklist: #15, #16, #22
Ch. 9: Approvals	IRP checklist: #17, #18

Cross-Reference with WAPA IRP Checklist

WAPA’s current IRP checklist² is included as follows along with references to the appropriate chapters in the IRP report addressing each item on the checklist. **References to the IRP report chapter are [added in blue text](#).** WAPA’s instructions regarding the checklist are:

In general, each customer must prepare and submit an IRP to WAPA that considers its electrical energy resource needs [\(905.11\(b\)\)](#). In order to satisfy the specific requirements of the regulation, the IRP must address the following questions. If WAPA concludes that the customer has satisfactorily answered the questions, and that the IRP is otherwise reasonable, WAPA should approve the IRP.

² Current as of January 2017

1. Does the IRP evaluate the full range of alternatives for new energy resources [\(905.11\(a\)\)](#)?
 - New generating capacity?
 - Power purchases?
 - Energy conservation and efficiency?
 - Cogeneration and district heating/cooling applications?
 - Renewable energy resources?

[Reference “Preferred Resource Plan” Ch. 6 \(w/ info from Ch. 4 & 5\)](#)

2. Does the IRP provide adequate and reliable service to the customer’s electric consumers [\(905.11\(a\)\)](#)?

[Reference “Preferred Resource Plan” Ch. 6](#)

3. Does the IRP take into account the necessary features for system operation [\(905.11\(a\)\)](#)?
 - Diversity?
 - Reliability?
 - Dispatchability?
 - Other risk factors?

[Reference “Supply-Side Resource Options” Ch. 5](#)

4. Does the IRP take into account the ability to verify energy savings achieved through energy efficiency [\(905.11\(a\)\)](#)?

[Reference “Demand-Side Resource Options” Ch. 4](#)

5. Does the IRP take into account the projected durability of such savings measured over time [\(905.11\(a\)\)](#)?

[Reference “Demand-Side Resource Options” Ch. 4](#)

6. Does the IRP treat demand and supply resources on a consistent and integrated basis [\(905.11\(a\)\)](#)?

[Reference “Preferred Resource Plan” Ch. 6](#)

7. Does the IRP consider electrical energy resource needs? The IRP may, at the customer’s option, consider water, natural gas, and other energy resource options [\(905.11\(b\)\)](#).

[Reference “Resource Needs” Ch. 3](#)

8. Does the IRP identify and compare resource options? The customer must conduct an assessment and comparison of available existing and future supply- and demand-side resource options based on its size, type, resource needs, geographic location and competitive situation. The options should relate to the customer’s unique resource situation as determined by profile data (service area, geographical characteristics, customer mix, historical loads, projected growth, existing system data, rates and financial information) [\(905.11\(b\)\(1\)\)](#).

- Supply-side options include, but are not limited to, power purchase contracts, and conventional and renewable generation options [\(905.11\(b\)\(1\)\(i\)\)](#).
- Demand-side options alter the customer’s use pattern to provide for an improved combination of energy services to the customer and ultimate consumer [\(905.11\(b\)\(1\)\(ii\)\)](#).
- Considerations that may be used to develop potential options include cost, market potential, consumer preferences, environmental impacts, demand or energy impacts, implementation issues, revenue impacts, and commercial availability [\(905.11\(b\)\(1\)\(iii\)\)](#).

[Reference “Preferred Resource Plan” Ch. 6](#)

9. Does the IRP clearly demonstrate that decisions were based on a reasonable analysis of the options [\(905.11\(b\)\(1\)\(iv\)\)](#)?

[Reference “Preferred Resource Plan” Ch. 6](#)

10. Does the IRP include an action plan describing specific actions the customer will take to implement the IRP [\(905.11\(b\)\(2\)\)](#)?

[Reference “Action Plan” Ch. 7](#)

11. Does the IRP list the time period that the action plan covers [\(905.11\(b\)\(2\)\(i\)\)](#)?

[Reference “Action Plan” Ch. 7](#)

12. Does the IRP include an action plan summary consisting of [\(905.11\(b\)\(2\)\(ii\)\(a-c\)\)](#):

- Actions the customer expects to take in accomplishing the goals identified in the IRP?
- Milestones to evaluate accomplishment of those actions during implementation?
- Estimated energy and capacity benefits for each action planned?

[Reference “Action Plan” Ch. 7](#)

13. Does the IRP, to the extent practicable, minimize adverse environmental effects of new resource acquisitions and document these efforts [\(905.11\(b\)\(3\)\)](#)?

[Reference “Preferred Resource Plan” Ch. 6](#)

14. Does the IRP include a qualitative analysis of environmental effects in a summary format [\(905.11\(b\)\(3\)\)](#)?

[Reference “Preferred Resource Plan” Ch. 6](#)

15. Does the IRP provide ample opportunity for full public participation in preparing and developing the IRP [\(905.11\(b\)\(4\)\)](#)?

[Reference “Member & Public Input” Ch. 8](#)

16. Does the IRP include a brief description of public involvement activities [\(905.11\(b\)\(4\)\)](#)?

- How the customer gathered information from the public?
- How public concerns were identified?
- How information was shared with the public?
- How public comments were responded to?

[Reference “Member & Public Input” Ch. 8](#)

17. Does the IRP document that each MBA member approved the IRP, confirming that all requirements have been met [\(905.11\(b\)\(4\)\(i\)\)](#)?

[Reference “Approvals” Ch. 9](#)

18. Does the IRP contain the signature of each MBA member’s responsible official, or document passage of an approval resolution by the appropriate governing body [\(905.11\(b\)\(4\)\(i\)\)](#)?

[Reference “Approvals” Ch. 9](#)

19. Does the IRP contain a statement that the customer conducted load forecasting, including specific data [\(905.11\(b\)\(5\)\)](#)?

[Reference “Resource Needs” Ch. 3](#)

20. Does the IRP contain a brief description of measurement strategies for identified options to determine whether the IRP’s objectives are being met [\(905.11\(b\)\(6\)\)](#)?

[Reference “Action Plan” Ch. 7](#)

21. Does the IRP identify a baseline from which the customer will measure the benefits of IRP implementation [\(905.11\(b\)\(6\)\)](#)?

[Reference “Action Plan” Ch. 7](#)

22. Does the IRP specify the responsibilities and participation levels of individual members of the MBA and the MBA [\(905.12\(b\)\(2\)\)](#)?

[Reference “Member and Public Input” Ch. 8](#)

Additional Documents and Resources

In addition to public documents and information referenced in this report, the analyses documented in this report are supported by data and information available from a number of supplemental documents and sources that are not otherwise publicly available. These documents may be available for review by WAPA, if requested and deemed necessary, with acceptable handling and confidentiality agreements.

Chapter 2: Current Resources

The CIPCO system currently uses a variety of demand-side, supply-side, and transmission resources to meet the needs of its member systems in a reliable and economical manner. Demand-side resources include programs to promote established and emerging energy-efficient technologies to reduce energy consumption or shift load to off-peak hours. Energy-efficiency programs are complemented by interruptible load programs to reduce the amount of power used at times of high system demand. Supply-side resources include large, central-station power plants, smaller generation resources, numerous renewable energy facilities, and both short- and long-term power purchase contracts. The transmission networks of CIPCO and its regional partners deliver power from supply resources to the distribution systems of its members systems in an efficient and reliable manner. The distribution networks of its member systems then deliver power to consumers' homes and businesses.

CIPCO's current resources are described in detail in this chapter.

Demand-Side Resources

CIPCO has promoted the installation of energy-efficient products and has educated customers about the benefits of energy efficiency for more than three decades. Since 1985, CIPCO and its member distribution cooperatives have offered a wide range of Demand-Side Management (DSM) programs designed to provide value to its membership base while promoting consumer interest in energy efficient products and behaviors.

From 1985 to 2005, the number and type of DSM programs offered by CIPCO and its member systems expanded significantly and have continued to evolve over the past decade. Over time, CIPCO's portfolio of energy-efficiency programs has focused more closely on the efficiency of electrical equipment, with a reduced focus on programs influenced by fuel switching. Program refinements in 2008 and 2010 increased the number of measures focused on the agricultural, commercial, and industrial sectors. During this time, CIPCO added incentives for heat pump water heaters, appliance recycling, and new lighting measures.

In 2014, CIPCO contracted with Cadmus to conduct an energy-efficiency "potential" study to determine the technical, economic, achievable, and programmatic energy-efficiency potential that might be realized in CIPCO's service territory for the 2015 to 2019 timeframe. Following the "potential" study, Cadmus worked with CIPCO to develop their current five-year Energy Efficiency Plan³.

This most recent energy-efficiency "potential" study revealed that several measures were no longer providing significant impacts due to market saturation and adoption of new federal efficiency standards. As a result, most residential ENERGY STAR appliance incentives were eliminated from CIPCO's most recent Energy Efficiency Plan. Several lighting measures were removed or incentives reduced due to market transformation that has resulted from years of utility promotion as well as technical advances that have significantly lowered the costs of these products.

³ "CIPCO Energy Efficiency Plan 2015-2019", September 2014, prepared by The Cadmus Group, Inc.

The focus of lighting programs has changed from fluorescent products to more costly LED lighting products while the baselines used for determining energy savings have dropped dramatically. As a result, these programs were seeing less energy saved per dollar spent. To combat this issue, CIPCO focused more of its attention and budget to the “Be Bright” retail program⁴ where discounts on LED lighting products are offered directly from the retailer and suppliers.

The promotion of energy-efficiency measures such as efficient air conditioning equipment (including electric heat pumps), agricultural ventilation, and lighting have reduced CIPCO’s summer energy consumption and peak demand, the key drivers of CIPCO’s incremental resource needs.

New measures are evaluated on an ongoing basis and are added to programs if they meet criteria and add value to the CIPCO system and its membership. See Section 4.0 for additional information about DSM programs and measure evaluation.

CIPCO’s current portfolio of DSM program offerings is presented in Table 1.

Table 1 - CIPCO DSM Program Measures

Residential		
Geothermal Heat Pumps	Heat Pump Water Heaters	Residential Indoor Lighting
Air Source Heat Pumps	Geo-assisted Water Heaters	Outdoor Security Lighting
Heat Recovery Ventilation	Drain Water Recovery Pipes	Residential Weatherization
Central Air Conditioners	Low Flow Aerators	Appliance Recycling
ECM Furnace Fan Replacements	Low Flow Shower Heads	All Electric Homes
Water Heater Tank & Pipe Insulation	Energy Star Clothes Washers	
Commercial & Industrial		
Geothermal Heat Pumps	Water and Air-Cooled Chillers	Commercial Indoor Lighting
Air Source Heat Pumps	Variable Speed Drives	Outdoor Lighting
Commercial Air Conditioners	Heat Recovery Ventilation	Custom Rebates
Commercial Kitchen Equipment	ECM Fan Motors	
Agricultural		
Livestock Ventilation Fans	Livestock Circulation Fans	Agricultural Indoor Lighting
Farrowing Heat Lamps and Pads	Efficient Livestock Waterers	Dairy Milk Pre-Coolers
Dairy Variable Speed Vacuum Pumps	Dairy Scroll Compressors	Dairy Heat Reclaimers

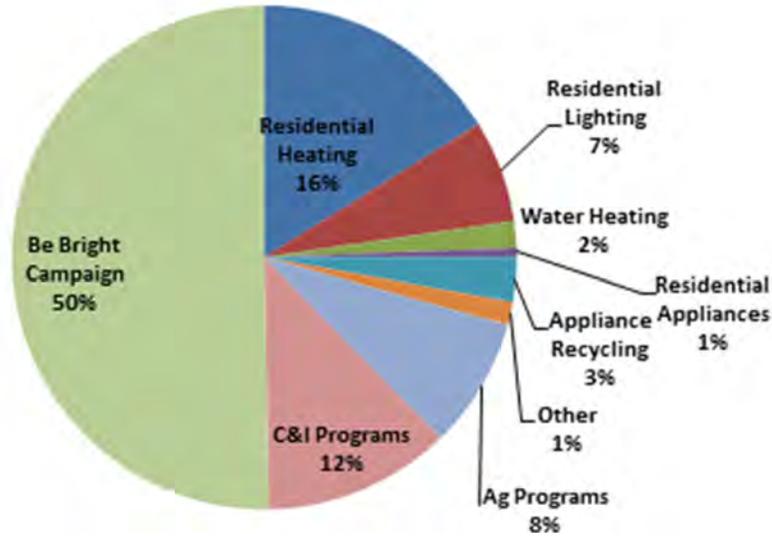
The estimated energy savings shares from CIPCO’s 2015 DSM programs are illustrated in Figure 2⁵. It should be noted that programs with fuel choices (such as heat pumps) are assumed to be electric-to-electric conversions for graphing purposes. One-half of the energy savings from CIPCO’s 2015 DSM programs came from the “Be Bright” retail lighting program. An additional 16 percent came from residential heating programs, while a combined 20 percent came from programs offered to commercial, industrial, and agricultural consumers.

⁴ www.iowabebright.com

⁵ 2016 data was not available at the time of IRP development

Figure 2

2015 Portfolio Savings Allocation



On a cumulative basis since inception, CIPCO’s DSM programs have decreased annual peak demand but have increased annual residential electricity sales. The upward net impact of DSM programs on electricity sales has been primarily due to consumers’ selection of high-efficiency electric heat pump equipment over non-electric heating alternatives. This causes a reduction in overall energy consumption (on a BTU basis) but an increase in electricity consumption during the winter months. While many programs aim at reducing electrical energy use, the amount of overall reduction is partially offset by the increase in electric requirements resulting from heat pump programs and the cumulative impact of historical high-efficiency electric appliance promotion programs. The overall upward impact on energy sales has been partially mitigated since 2010 due to increased promotion of high-efficiency electrical equipment and reduced fuel switching.

CIPCO’s DSM programs have had a measureable impact on appliance ownership trends within its system. Data from CIPCO’s end-use surveys conducted every three years indicate that ground-source (geothermal) heat pumps have been displacing electric resistance heating on the CIPCO system, and that the pace of displacement has increased over the past decade, as illustrated in Figure 3. Furthermore, promotion of high-efficiency heat pump equipment has led to increasing heat pump saturations for home air conditioning, particularly in new homes. Figure 4 illustrates the break-down of air conditioning system types by the age of the home. Of homes built within the most recent five years (2010 to 2014) that have a central air conditioning system, approximately one-third use heat pumps, while a much smaller share of older homes use heat pumps for air conditioning, as shown in Figure 4.

Figure 3

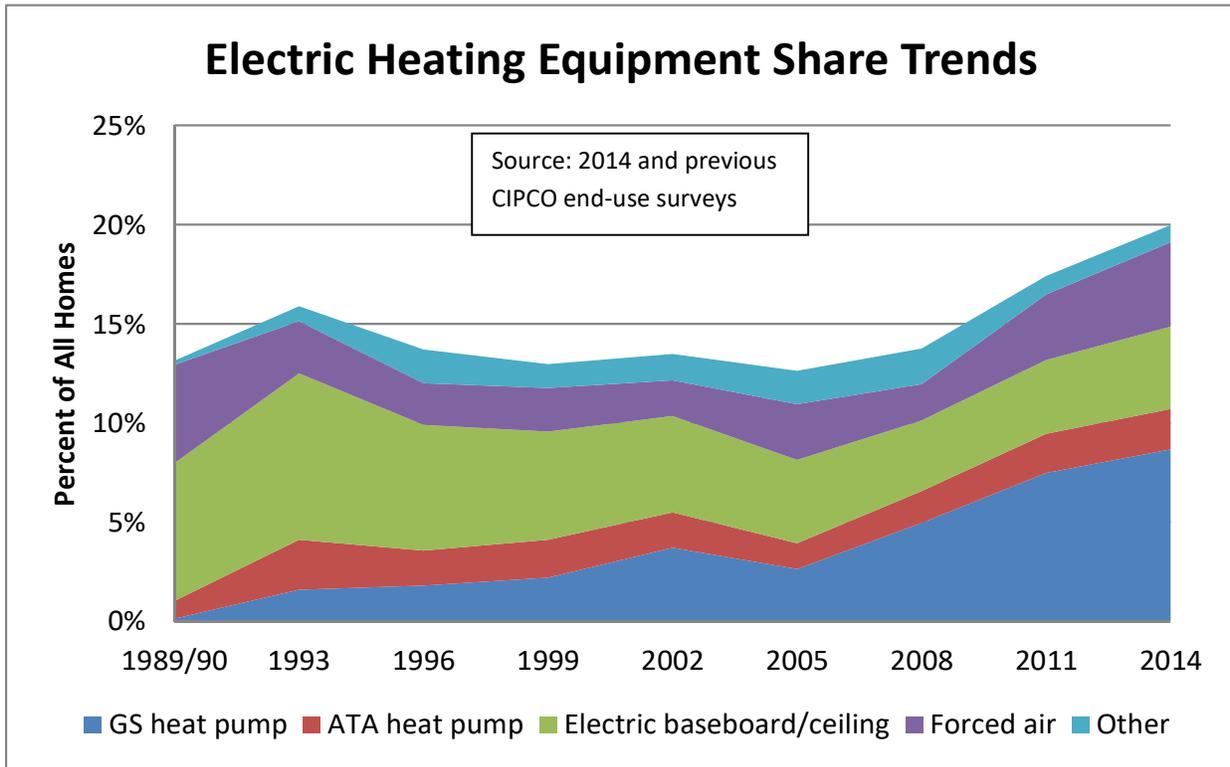
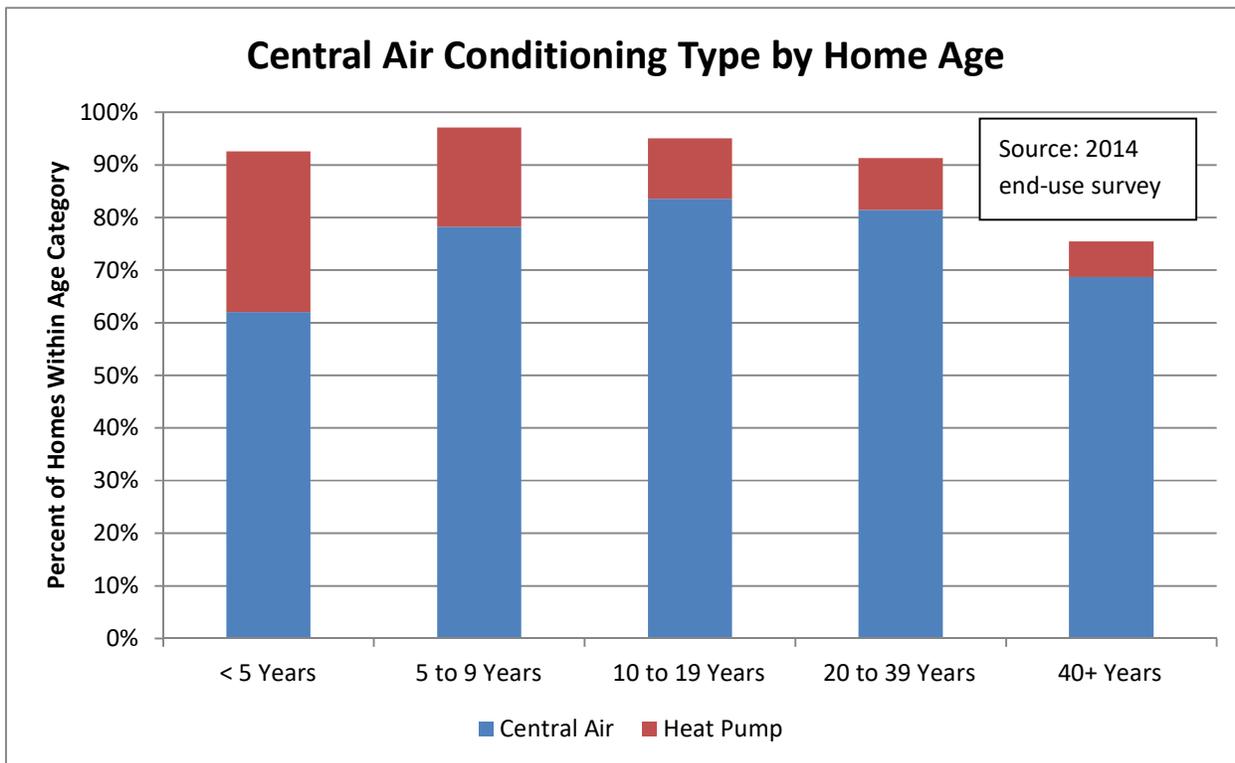


Figure 4



Recent end-use surveys also track market transformations occurring on the CIPCO system due, in part, to promotional programs offered by CIPCO and its member systems. The 2014 end-use survey indicated:

- Nearly 60 percent of homes have a high-efficiency clothes washer
- Approximately 88 percent of homes use some CFL lights and 40 percent used some LED lighting
- Fourteen percent use heat pump technology for water heating, with 11 percent using heat recovery from geothermal heat pumps and three percent with stand-alone heat pump water heaters

CIPCO and its member systems have promoted these appliances for a number of years, and have helped foster these market transformations. The next end-use survey is scheduled for the fall of 2017, and will continue to track appliance trends and market transformations among the CIPCO membership.

CIPCO's commercial and industrial (C&I) DSM programs reduced C&I electricity sales by an estimated 4.7 percent in 2015 (cumulative impacts by 2015). By 2035, these programs are projected to reduce annual energy sales to this class by approximately 10 percent. Over time, the increase in electric use seen from heat pump programs are expected to be more than offset by the efficiency impacts of the other commercial and industrial DSM programs, such as lighting retrofits, variable speed drives, and customized energy-efficiency improvements.

These long-term DSM impact estimates are integrated into CIPCO's 2016 load forecast study, which is a cornerstone of the resource needs discussed in Chapter 3. Overall, the total impact of all DSM programs on total energy requirements is estimated to be an increase of 10,930 MWh in 2015, or approximately 0.8 percent. This is expected to remain relatively stable on an annual basis, resulting from increases in winter energy consumption (due to heat pumps) and decreases in summer energy consumption. The summer peak demand savings are estimated to be 19.0 MW in 2016 and are expected to increase to 20.5 MW by 2035. CIPCO's winter peak demands increase as a result of DSM programs largely due to the addition of electric heat pumps. While providing consumers with overall energy savings on a BTU basis, it is assumed that heat pumps increase winter electricity consumption and winter peak demand due to fuel switching away from propane and natural gas.

CIPCO initiated an interruptible rate schedule in 1995, Rate Schedule A-2, that gives qualifying C&I consumers the opportunity to reduce their power costs by installing back-up generation for use during periods of system load curtailment. Schedule A-2 interruptible rates are used to:

- Lower power costs by reducing the need for marginal supply-side resources;
- Provide competitive offerings for the C&I sector; and
- Reduce demand during peak periods.

Twenty C&I interruptible consumers were on the Schedule A-2 rate in 2015. In addition, three of CIPCO's largest industrial consumers have negotiated long-term, three-party, interruptible sales contracts. The total potential interruptible load impact at the time of CIPCO's 2015 annual peak demand was

approximately 12.0 MW (associated with both A-2 and contract interruptible customers), and is expected to increase to 24.3 MW by July 2035.

CIPCO has tracked its energy-efficiency program participation and impacts since program inception in the 1980s. Annual participation and energy impacts (at the retail meter; excluding system losses) for DSM programs are summarized over the 2011 to 2015 period in Table 2.

Table 2 – DSM Program Participation and Impacts 2011-2015

	Number of New Participants					Cumulative MWh Impacts (at retail meter)				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Residential Programs										
Heat Plus	123	57	58	65	60	8,020	8,695	9,096	9,511	9,950
Dual Fuel	0	0	0	0	0	17,062	15,118	13,231	11,392	9,675
Interruptible	0	0	0	0	0	4,225	3,568	3,119	2,610	2,040
Air Source Heat Pumps	291	262	261	282	332	13,716	14,769	15,737	16,676	17,681
Geothermal Heat Pumps	612	598	596	580	536	33,837	35,647	37,422	39,138	40,668
Conventional Water Heater Program	0	0	0	0	0	140	125	114	105	96
Premium Quality Water Heater	1,223	1,113	1,079	1,063	855	19,462	18,244	16,786	15,007	13,080
Drain Water Recovery Pipe	1	0	1	1	2	(0)	(1)	(1)	(2)	(2)
Heat Pump Water Heater	147	214	174	213	150	(302)	(647)	(1,015)	(1,378)	(1,719)
All Electric Home	43	40	31	31	38	1,065	1,045	1,030	1,003	926
Heat Recovery Ventilation	121	179	95	106	130	(115)	(147)	(177)	(198)	(224)
Central Air Conditioners	814	770	714	823	1,050	(4,521)	(4,510)	(4,424)	(4,293)	(4,223)
Energy Star Clothes Washer	1,934	1,670	1,637	1,204	396	(1,573)	(1,889)	(2,157)	(2,388)	(2,517)
Energy Star Dishwasher	753	764	755	631	187	(811)	(872)	(934)	(990)	(1,023)
Energy Star Refrigerator	2,219	2,193	2,100	1,493	275	(418)	(510)	(593)	(663)	(697)
Freezer	359	410	389	323	21	(22)	(41)	(59)	(76)	(84)
Dehumidifier	315	210	281	241	23	(38)	(58)	(76)	(95)	(105)
Efficient Television	540	607	598	591	145	(54)	(123)	(195)	(266)	(311)
Electronic Recycling	966	1,238	1,243	829	904	(1,162)	(2,000)	(2,986)	(3,803)	(3,987)
Residential Indoor Lighting (# bulbs)	79,284	238,344	301,109	271,474	324,253	(13,772)	(18,339)	(24,906)	(29,484)	(32,114)
Outdoor Security Lighting	1,440	1,137	1,495	2,012	2,828	(564)	(726)	(1,018)	(1,503)	(2,160)
Energy Star Window Air Conditioner	159	177	105	56	1	(18)	(26)	(32)	(36)	(37)
Low Flow Aerators	38	147	113	121	76	(70)	(81)	(95)	(109)	(120)
Low Flow Showerheads	40	144	72	360	76	(183)	(210)	(242)	(306)	(370)
Water Heater Tank and Pipe Insulation	198	48	137	0	0	(6)	(10)	(13)	(15)	(15)
Residential Weatherization	219	211	182	166	128	(106)	(227)	(347)	(455)	(538)
<u>ETS Space Heating</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>
Residential Total						73,821	66,825	57,294	49,414	43,901
Business & Agricultural Programs										
Commercial Air Source Heat Pumps	81	49	139	27	68	650	711	791	859	896
Commercial Geothermal Heat Pumps	443	151	416	164	144	2,435	2,471	2,485	2,495	2,470
Commercial Heat Recovery Ventilation	140	48	6	10	15	(152)	(259)	(290)	(299)	(313)
Premium Motors	0	0	0	0	0	(20)	(20)	(20)	(20)	(20)
Variable Speed Drives	29	19	27	5	56	(1,488)	(1,823)	(2,426)	(2,837)	(3,064)
Commercial Indoor Lighting (# bulbs)	13,365	30,102	35,439	29,421	31,362	(6,861)	(10,080)	(13,669)	(16,737)	(19,377)
Dairy Pre-Cooler	6	10	6	10	6	(517)	(555)	(590)	(627)	(668)
Livestock Ventilation Fans	25	38	165	31	245	(41)	(51)	(87)	(122)	(179)
Livestock Circulation Fans	7	34	30	9	0	(2)	(23)	(84)	(132)	(139)
Livestock Equipment	0	0	0	0	563	0	0	0	0	(311)
<u>Custom C&I</u>	<u>5</u>	<u>5</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>(203)</u>	<u>(526)</u>	<u>(965)</u>	<u>(1,556)</u>	<u>(2,224)</u>
General C&I Total						(6,199)	(10,156)	(14,854)	(18,977)	(22,927)
CIPCO System Total						67,622	56,670	42,440	30,437	20,974

Supply-Side Resources

CIPCO's supply-side resources consist primarily of power plants, distributed generation facilities, long-term power purchases, and a modest amount of supplemental short-term power purchases. CIPCO utilizes nuclear, natural gas, coal, oil, hydro, solar, landfill gas, and wind power in its supply mix. This diverse power supply mix consists of 580 MW of summer capacity⁶ that meets most of CIPCO's capacity requirements and all of its energy requirements, limiting exposure to power market price and liquidity risks. CIPCO's joint ownership of several baseload units contributes to diversity by spreading ownership risk over multiple parties and reducing CIPCO's dependence on any single resource. Joint plant ownership also enhances economies of scale, allows for high-volume fuel procurement, and provides other benefits associated with operating large, central-station generation assets. Approximately 95 percent of CIPCO's total energy requirements are generated in the state of Iowa.

This commitment to diverse supply-side resources and ownership structures enables CIPCO to provide reliable, dispatchable power to its member-systems. Diverse fuel sources reduce dependencies on any one fuel type, fuel source, and fuel delivery method. Some reliance on electric power purchases contributes to diversifying the resource mix, eliminates ownership risks, and increases overall reliability. Most of CIPCO's purchases are price-certain, long-term contracts that allow for greater financial certainty while limiting exposure to the variability of the open market. Short-term contracts allow CIPCO to meet any additional needs without committing to long-term arrangements, and to provide flexibility to address near-term load variations.

CIPCO considers itself an environmental steward and takes that role into consideration when evaluating supply-side resources. Approximately 60 percent of CIPCO's energy currently comes from resources that do not emit air pollutants that endanger public health and welfare⁷, such as sulfur dioxide, nitrous oxides, mercury, carbon monoxide, and carbon dioxide. This share is anticipated to remain relatively stable into the future as CIPCO seeks additional opportunities for power purchase contracts or ownership of solar and wind facilities.

In addition to a diverse energy portfolio, CIPCO members continue to achieve scale from ongoing participation in a broad and economically-robust pooling arrangement with Alliant Energy/IPL. CIPCO is able to participate in this resource mix at a scope and scale that exceeds 3,500 MW (nameplate), while gaining access to the larger MISO power market with its abundance and diversity of resources.

CIPCO's major supply-side resources are described in the following sections.

CIPCO-Owned Generation

CIPCO owns all or a portion of nine generating units at four central-station power plants in Iowa. The size, ownership share, and operators of these plants are summarized in Table 3. Each plant is briefly described following the table.

⁶ Nameplate capacity, excluding any SIMECA or municipal generation

⁷ As defined by the Clean Air Act

Table 3 - CIPCO-Owned Generation

	Total Plant Capacity	CIPCO Ownership Share		Plant Operator
	Winter MW	MW	%	
NextEra Energy Duane Arnold	622	124.4	20.0%	NextEra Energy
Louisa Generating Station	746	34.3	4.6%	MidAmerican Energy
Walter Scott #3	704	81.0	11.5%	MidAmerican Energy
Walter Scott #4	818	78.1	9.55%	MidAmerican Energy
Summit Lake (2 gas turbines, 3 heat recovery steam units)	85	85.0	100%	CIPCO

NextEra Energy Duane Arnold LLC

The NextEra Energy Duane Arnold plant (previously the Duane Arnold Energy Center, DAEC), located near Palo, is Iowa’s only nuclear generating facility. CIPCO owns a 20 percent share of the 622 MW (winter capability) facility which is operated by NextEra Energy. Duane Arnold began commercial operation in 1974 and received a license extension from the Nuclear Regulatory Commission (NRC) in December 2010, allowing it to operate until 2034.

Louisa Generating Station

Louisa Generating Station (Louisa) is a coal-fueled generation plant located near Muscatine, Iowa that began operation in 1983. CIPCO owns 4.6 percent of this 746 MW facility, which is operated by MidAmerican Energy. Louisa is equipped with an Electrostatic Precipitator (ESP) with flue gas conditioner, activated carbon injection, scrubber, baghouse, low-NO_x burners with overfire air, and was originally constructed with cooling towers.

Walter Scott, Jr. Energy Center

Walter Scott, Jr. Energy Center #3 (WS #3) is a unit of the Walter Scott, Jr. Energy Center complex, located near Council Bluffs, Iowa. CIPCO owns 11.5 percent of this 704 MW (winter capability) coal-fired generation unit. MidAmerican Energy operates the facility, which began production in 1979. WS #3 is equipped with an ESP, activated carbon injection, scrubber, baghouse, and low-NO_x burners with overfire air.

Walter Scott, Jr. Energy Center #4 (WS #4) is the newest unit at the complex. Production began in 2007 at this 818 MW (winter capability) coal-fired facility. CIPCO owns 9.55 percent, or 78 MW (winter capability), of this unit. WS #4 is equipped with a Selective Catalytic Reduction (SCR), scrubber, baghouse, activated carbon injection, low-NO_x burners with over-fire air, and cooling towers.

Summit Lake

Summit Lake is located near Creston, Iowa and is a natural gas fired peaking generation plant capable of either simple or combined cycle operation. The facility has a winter capacity of 85 MW, and consists of two combustion turbines, two heat recovery steam generators (HRSGs), three steam turbines, and the original cooling tower. The plant was constructed in 1952 as a baseload coal facility, became wholly-owned by CIPCO in 1968, and was fully repowered with natural gas-fired combustion turbines by 1975.

Fair Station - Retired

Fair Station was a wholly-owned coal-fired generation plant located in Montpelier, Iowa. The 1960-vintage facility consisted of two units, totaling 66 MW of capacity. It was shut down in November, 2013 for economic and environmental compliance reasons and the site of the plant was returned to a natural environment in 2015.

Long-Term Power Purchase Agreements

In addition to ownership in generation resources, CIPCO purchases substantial amounts of power through long-term power purchase agreements (PPAs) and contracts for the use of the diesel generation resources of SIMECA member municipal utilities as part of its system resources.

Western Area Power Administration (WAPA)

CIPCO receives energy from the Upper Great Plains Region of WAPA, a Federal Power Marketing Administration. CIPCO's allotment of WAPA power averages approximately 14 MW per month of hydroelectric power from dams on the Missouri River in Montana, North Dakota, and South Dakota through a power purchase contract.

Story County Wind Energy Center

Story County Wind Energy Center is a 150 MW wind farm located near Colo, Iowa. The facility began production in 2008 and is owned and operated by NextEra Energy. CIPCO has a PPA with NextEra Energy for 42 MW of output through early 2019.

Hancock County Wind Energy Center

Hancock County Wind Energy Center is a 98 MW wind farm located near Garner, Iowa. The facility began production in 2002 and is owned and operated by NextEra Energy. CIPCO has a PPA with Interstate Power and Light Company (IPL), one of the wind farm's off-takers, for 2 MW of output. The Hancock PPA was CIPCO's first foray into wind energy.

Elk Wind Farm

With the purchase of 100 percent of the output from the Elk Wind Farm in 2011, CIPCO nearly doubled the amount of wind power in its resource mix. Elk Wind Farm is a 41.25 MW wind facility located in Delaware County, Iowa and is owned by RPM Access. CIPCO purchases the output from this wind farm through a long-term PPA extending through 2031.

Hawkeye Wind Farm

The Hawkeye Wind Farm near Hawkeye, Iowa began production in 2012. It provides a maximum of 37.5 MW of power to CIPCO via a long-term contract extending through 2037.

Rippey Wind Farm

The Rippey Wind Farm near Grand Junction, Iowa began production in 2012. It provides a maximum of 50 MW of power to CIPCO via a long-term contract extending through 2037.

Pioneer Grove Wind Farm

The Pioneer Grove Wind Farm is located near Mechanicsville, Iowa and is owned by Acciona Windpower. CIPCO began purchasing 6 MW of power in 2012, with the contract extending until 2032.

HZ Wind

HZ Wind is a 4 MW wind site that began producing in 2012. It is currently contracted through the end of 2017, but renews annually.

Cooperative Wind Turbines

There are a number of wind turbines on member cooperative systems in CIPCO's service territory, ranging in size from 1.60 MW to 1.85 MW each. CIPCO has a contract for 100 percent of the output from this collection of turbines, known as "Small PURPA Wind". The total 2016 capacity of 6.75 MW is nearly doubling in 2017 to a total of 11.75 MW.

Other Small Wind

CIPCO also has small wind turbines on its system that first serve local municipal or cooperative load. Any excess energy produced by the 1.5 to 1.6 MW turbines is purchased by CIPCO. The total installed capacity of these "excess" turbines is approximately 9.4 MW.

Linn County Solid Waste Agency

In 2013, CIPCO began purchasing approximately 1.6 MW of waste-to-energy power from the Linn County Solid Waste Agency, located near Marion, Iowa and owned by Linn County. This contract extends through 2033.

Solar Power Generation Facilities

CIPCO contracted for development of five solar power facilities in 2016 with a total nameplate capacity of 4.42 MW_{AC}, all of which were energized by the end of 2016. This initial investment represents Phase I of CIPCO's planned solar developments. Phase II is in early stage development and construction, with approximately 6.0 MW_{AC} planned to be on-line by the end of 2017. CIPCO continues to explore opportunities for additional solar power development or purchases as solar installation prices fall and potential sites become available.

SIMECA and Other Municipal-Owned Generation

Most of the SIMECA communities and some other municipal utilities to which CIPCO provides either full or partial requirements have back-up municipal generation in the form of

reciprocating internal combustion engines. In total, CIPCO purchases approximately 70MW from these resources. CIPCO only purchases what is available from generating units that are fully compliant with the latest EPA standards. To the extent municipalities continue to retrofit their engines to comply with these standards, CIPCO may be able to purchase additional power from them in the future.

Miscellaneous Power Purchase and Sale Agreements

In order to supplement its owned resource base, CIPCO periodically enters into power purchase and sale agreements. This is done to help ensure reliability and enhance the overall system economics. Typically, annual regulatory capacity purchases are made to meet load and capability requirements, and baseload energy purchases are made to manage energy supply costs. If it is determined the CIPCO system is carrying too much supply, evaluations are performed to consider marketing such excess resources.

Transmission Resources and Facilities

CIPCO's transmission and sub-transmission facilities consist of 33 miles of 345 kV, 257 miles of 161 kV, 18 miles of 115 kV, 974 miles of 69 kV, and 613 miles of 34kV line including the CIPCO portion of jointly-owned lines. CIPCO provides power to 299 member-owned or co-owned substations which then provide power to the distribution systems of its member systems.

CIPCO continues to improve the efficiency of its transmission system and coordinates with its member systems to improve overall system efficiencies. These improvements include installation of low-loss transformers that decrease losses by an estimated 1.0 to 2.0 percent. This program has been in place for decades and has provided a significant amount of energy and peak demand savings to CIPCO and its member systems.

In addition, CIPCO coordinates with its member systems on their system construction work plans (WP). Construction work plans evaluate and plan future system improvements, typically over a four-year period. Construction work plans assess and incorporate the following elements:

- A review of the current system infrastructure and performance
- An analysis of historic and future loads and trends
- A discussion of the planning criteria used in the plan, from both engineering and economic perspectives
- Recommendations for infrastructure improvements, including poles, wires, substations, and related equipment
- An assessment of the reliability and financial impacts of the recommended improvements on the system and its members

The first years of the most recent construction work plans completed by CIPCO’s distribution cooperative members are included in the following list. These plans typically encompass a four-year period, but are occasionally extended if, for example, recommended work is not fully completed or if load growth slows below the levels anticipated in the work plans.

<u>Cooperative</u>	<u>Construction Work Plan Start Date</u>
Clarke	2013
Consumers	2016
Eastern Iowa	2014
East-Central Iowa	2017
Farmers	2013
Guthrie	2015
Linn	2010
Maquoketa Valley	2012
Midland	2013
Pella	2009
SW Iowa	2013
T.I.P.	2006

CIPCO is directly interconnected with MidAmerican Energy, ITC Midwest, WAPA, and several independent municipalities. ITC Holdings Corporation (ITC Midwest) purchased Interstate Power and Light Company’s (an Alliant Energy subsidiary) transmission system in 2007. These direct interconnections enhance reliability and facilitate the purchase and sale of energy between CIPCO and neighboring systems.

While not a member, CIPCO is a market participant in the Midcontinent Independent System Operator (MISO). MISO has responsibility for regional transmission system planning and reliability. CIPCO’s participation in MISO allows it to be actively involved in the identification of, and planning for, new transmission lines within the CIPCO footprint or within the broader region that may impact the CIPCO system. Participation in MISO and membership in ACES (formerly known as “ACES Power Marketing”) allow CIPCO to monitor and participate in MISO planning activities.

CIPCO and ITC Midwest have an Operating and Transmission (O&T) Agreement that allows mutual use of the integrated transmission system. CIPCO maintains an equitable investment of 31 percent of the integrated system. This agreement allows mutually-beneficial transmission access, allows for shared responsibility for infrastructure costs and O&M costs, and helps ensure reliability across a broad portion of CIPCO’s footprint.

Chapter 3: Resource Needs

CIPCO's future resource needs are determined primarily by changes in load, and to some extent, the characteristics of the load served. The impacts of DSM programs, planned changes to existing resources, and emerging issues such as consumer-owned generation may also impact the outlook for future resource needs.

CIPCO has an established, comprehensive load forecasting process that regularly updates the load forecast for the CIPCO system and all of its member systems. The most recent load forecast was completed in the fall of 2016 and included forecasts over the 2016 to 2035 period. These forecasts form the basis for future capacity and energy needs that must be met through a combination of supply-side and demand-side resources. DSM impacts are explicitly incorporated into the base-case load forecast.

In addition to the load forecast, changes to existing generation resources and power purchases will also impact the amount of new resources required over the planning horizon. The potential retirement of some generation units and the known expiration of various PPAs are significant changes to existing resources that are anticipated over the IRP planning horizon. The impacts of consumer-owned generation are relatively small and future growth is uncertain, and the impacts are being tracked for possible future analysis and incorporation, should the magnitude justify such treatment.

As noted previously, CIPCO's long-term guideline is to limit exposure to market price volatility and manage risks by supplying at least 85 percent of its annual energy needs from owned resources and long-term PPAs. Depending on market conditions, CIPCO may deviate from this strategy for short periods to take advantage of market opportunities as they arise.

CIPCO's expected resource needs over the next 15 years are discussed in this section.

Load Forecast

The CIPCO load forecasting process is "bottom-up". Forecasts for each of CIPCO's member rural electric cooperatives are developed at the retail class level, and are aggregated to the system level. Energy deliveries by CIPCO to distribution cooperatives include all retail sales plus their own use and distribution losses, less any non-CIPCO power purchases. Monthly peak demand forecasts are developed for each cooperative, including their contribution to the CIPCO system peak demand.

Load forecasts are developed for the SIMECA system and are allocated to each member system based on their share of load growth. SIMECA member forecasts include energy purchases from CIPCO and each SIMECA member's contribution to the CIPCO system monthly peak demand.

The CIPCO system load forecast is the sum of all member systems' energy purchases and coincident peak demands, plus CIPCO's own use and transmission losses. In this manner, the forecasts across the entire CIPCO system are developed in a bottom-up manner using consistent data sources, methodologies, and assumptions. Load forecasts explicitly incorporate the historic impacts and projected future impacts of DSM programs on energy sales and peak demands.

The CIPCO load forecast is documented in a detailed report that was approved by its Board of Directors on October 18, 2016 and approved by the Rural Utilities Service (RUS) on November 16, 2016. The load forecast complies with RUS load forecasting regulations as detailed in 7 CFR, part 1710, Subpart E of the Federal Register.

The forecasting methodologies and results are summarized in the following sections.

Residential Class Forecasts

The residential class is the largest consumer class, comprising 54 percent of retail electricity sales across CIPCO's 12 distribution cooperatives. Residential consumer forecasts for each of CIPCO's distribution cooperatives are based on household forecasts for the primary counties served and a trend in the share of those households served. Average energy use per residential consumer forecasts are developed using both econometric and end-use modeling, with cooperative managers selecting a weighting between the two forecasts. The number of residential consumers is projected to increase at an average annual rate of 1.0 percent over the forecast horizon, while average energy use per consumer decreases slightly over time. Total sales to the residential class increase at an average annual rate of 0.8 percent over the 2016 to 2035 forecast horizon.

Commercial and Industrial Class Forecasts

CIPCO's 12 distribution cooperatives served 13,137 small commercial and industrial (C&I) and 74 large C&I consumers in 2015, as reported on RUS Operating Report-Distribution (Form 7). Forecasts of the number of small C&I consumers and average energy use per small C&I consumer are developed using econometric modeling or judgment. Small C&I energy sales increase at an average annual rate of 1.9 percent from 2016 to 2035. Forecasts for large C&I customers are developed individually, or as a group within a distribution cooperative system, with input from the member systems. Energy sales to the large C&I class increase at an average annual rate of 2.0 percent from 2016 to 2035, including the addition of a large pipeline pumping station in 2017.

Other Retail Class Forecasts

CIPCO's member distribution cooperatives also serve consumers classified as seasonal, irrigation, street lighting, public authority, and sales for resale. Sales to these classes comprise less than five percent of total retail energy sales by the member distribution cooperatives, and forecasts are developed using trending techniques and judgment, with input from the member systems.

WAPA sales to the City of Stanton, Iowa are not included in these forecasts. The "net" power provided to Stanton (beyond its WAPA power purchase) is included as a resale for Southwest Iowa REC.

Total Sales to Distribution Cooperatives

Total CIPCO electricity sales to its electric cooperative member systems are the sum of their retail electric sales plus their own use and distribution losses, less wind power purchased by one member system under a separate contract. Own use and losses are projected based on historic averages.

The impacts of CIPCO's DSM programs are incorporated into the base-case load forecasts presented in this section. A relatively small amount of consumer-owned distributed generation is also embedded in

the base-case load forecast. CIPCO continues to monitor technology advancements and track installations of consumer-owned generation through its annual load forecasting process.

Preliminary load forecasts for CIPCO's 12 member distribution cooperatives are reviewed with each member system manager in a formal review process that includes either face-to-face meetings or teleconferences. Based on each manager's input, DSM and load forecasts are revised and finalized, and are formally approved by each member system manager.

SIMECA Forecasts

CIPCO also provides all or partial power requirements to 15 municipal electric systems who are members of the South Iowa Municipal Electric Cooperative Association (SIMECA). The SIMECA energy forecasts are developed using econometric modeling at the aggregate level and are allocated to the 15 systems based on historic growth shares. Monthly peak demand forecasts are developed for each system using a load factor approach. A data request was sent to each SIMECA system to solicit input, and forecasts were provided to each member system for comment. SIMECA load growth averages 0.6 percent per year over the 2016 to 2035 forecast horizon.

The SIMECA forecasts included in the CIPCO power requirements represent the "net" power provided by CIPCO, beyond the purchases from WAPA by the cities of Corning, Fontanelle, Lenox, and Villisca.

Total CIPCO Energy Requirements and Peak Demands

CIPCO'S total energy requirements forecast adds energy sales to distribution cooperatives plus sales to SIMECA members, CIPCO's own use, and transmission losses. CIPCO's total energy requirements are expected to increase at an average annual rate of 1.3 percent over the 2016 to 2035 forecast period as the housing sector recovers and growth continues in the business and agricultural sectors. This is below the 2.4 percent annual pace experienced over the past 20 years, but faster than the slight decrease experienced over the last five years, which included reduced purchases by some large C&I customers along with relatively mild weather in 2015.

Monthly peak demand forecasts for the CIPCO system are developed by summing the coincident contribution of each member system to the CIPCO peak demand in each month, plus CIPCO's own use and transmission losses. CIPCO's annual system peak is expected to increase at an annual rate of 1.3 percent from 2016 to 2035.

The energy requirements and peak demand forecasts are provided both with and without the impacts of DSM programs. The "net" load forecasts including DSM are considered the base-case forecasts for planning purposes, while the "gross" load forecasts excluding DSM can be used as a starting point for evaluating demand-side resource alternatives.

CIPCO's annual energy requirements and seasonal peak demands are presented in Figure 5 and Figure 6, respectively. CIPCO is a summer-peaking utility on a normal-weather basis and is expected to remain so over the planning horizon. The peak demands that are illustrated represent the "operating" peak demands that would be recorded on the system. Firm peak demands are discussed later in this report and are also relevant for resource planning.

Figure 5

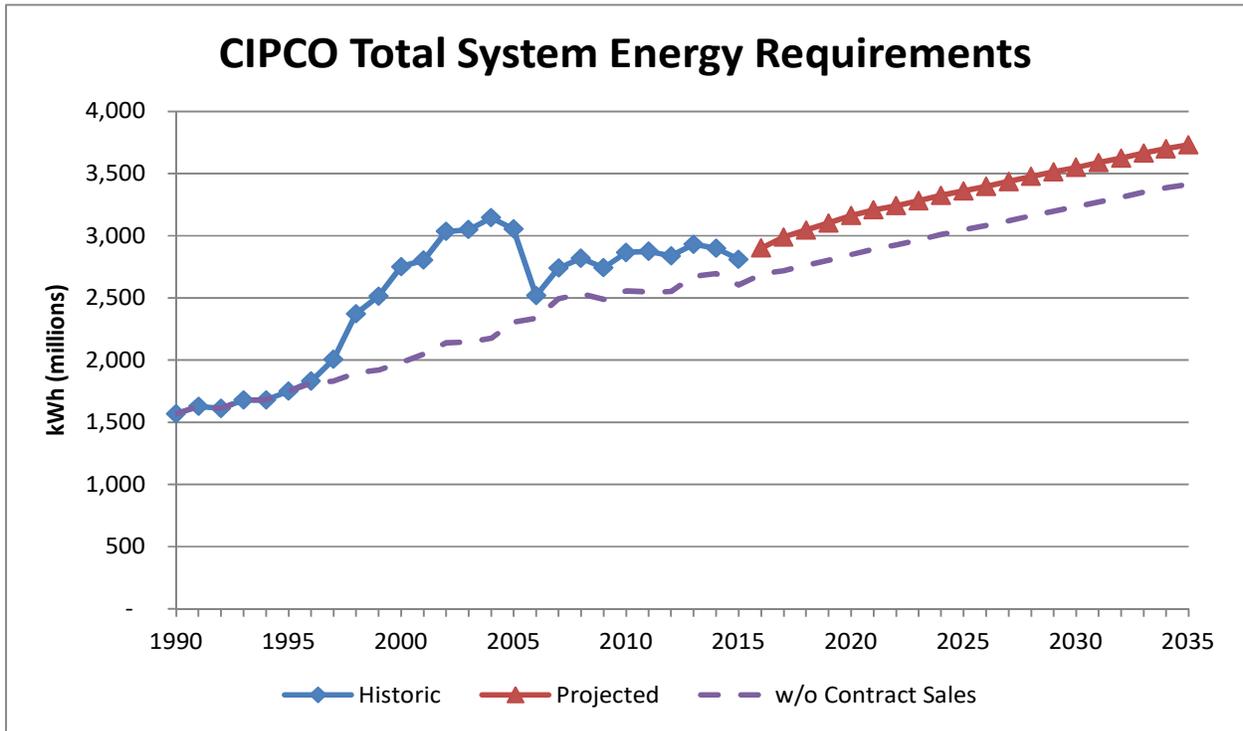
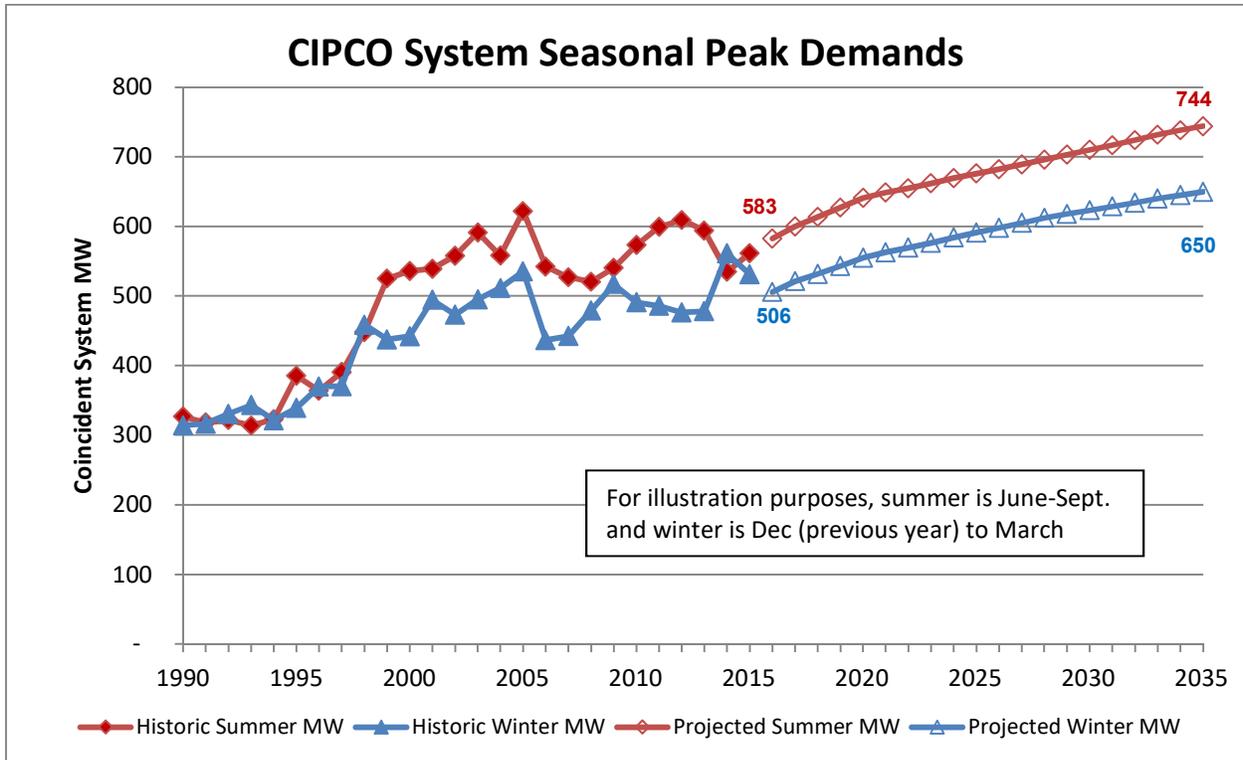


Figure 6



In addition to the “base-case” forecasts, CIPCO also develops a range of forecasts to reflect the uncertainty in future weather and economic conditions. The forecast scenario ranges include:

- Extreme weather with normal economic growth
- Mild weather with normal economic growth
- Rapid economic growth with normal weather
- Slow economic growth with normal weather

These ranges allow CIPCO to develop contingency resource and financial plans to respond appropriately to future conditions that will, in all likelihood, deviate somewhat from the assumptions used in the base-case forecast. They also correspond with the requirements of the RUS for evaluating load forecast uncertainty and developing forecast ranges and are documented in the load forecast report.

Changes to Existing Resources

While the load forecast is the primary determinant of future resource needs, changes to existing resources will also influence the amount of power required from new resources.

The following significant changes to CIPCO’s existing resources are anticipated over the next 15 years:

- Story County Wind PPA expires 4/26/2019
- Summit Lake steam turbines to be retired within the IRP horizon
- Hancock Wind PPA ends 12/31/2027

Other Drivers of Resource Needs

In addition to the load forecast variations and changes to existing resources, there are a number of factors that could impact CIPCO’s future resource needs. Some examples include:

- Strong economic growth, either on a broad basis or industry-specific growth such as pipelines, ethanol facilities, or data centers.
- Widespread adoption of new technologies that use significant amounts of electricity, such as electric vehicles.
- Future environmental regulations that could diminish the number of hours certain generation facilities could operate or cause facilities to be mothballed or retired. This would create the need for replacement power from other generation resources or power purchases.
- Relative changes in fuel prices.
- Substantial increases in the amount of small-scale, consumer-owned generation, potentially reducing the need for central-station generation and transmission facilities. This is challenging since increases in intermittent resources require ongoing grid and generation support.
- New technology advancement that could further accelerate the adoption of energy efficiency, demand response, and power storage resources.

Resource Needs Summary

As discussed in this chapter, the impacts of load growth, potential generation unit retirements, expiration of PPAs, and the impacts of cost-effective DSM will require the acquisition of additional resources over the IRP planning horizon. Figure 7 and Table 4 provide CIPCO’s projected resource needs and its existing resources available to meet those needs over the IRP horizon.

New resource acquisitions will consist of some combination of incremental DSM efforts, new generation resources, and new power purchase agreements. Those options will be discussed in detail in subsequent chapters of this report.

Figure 7

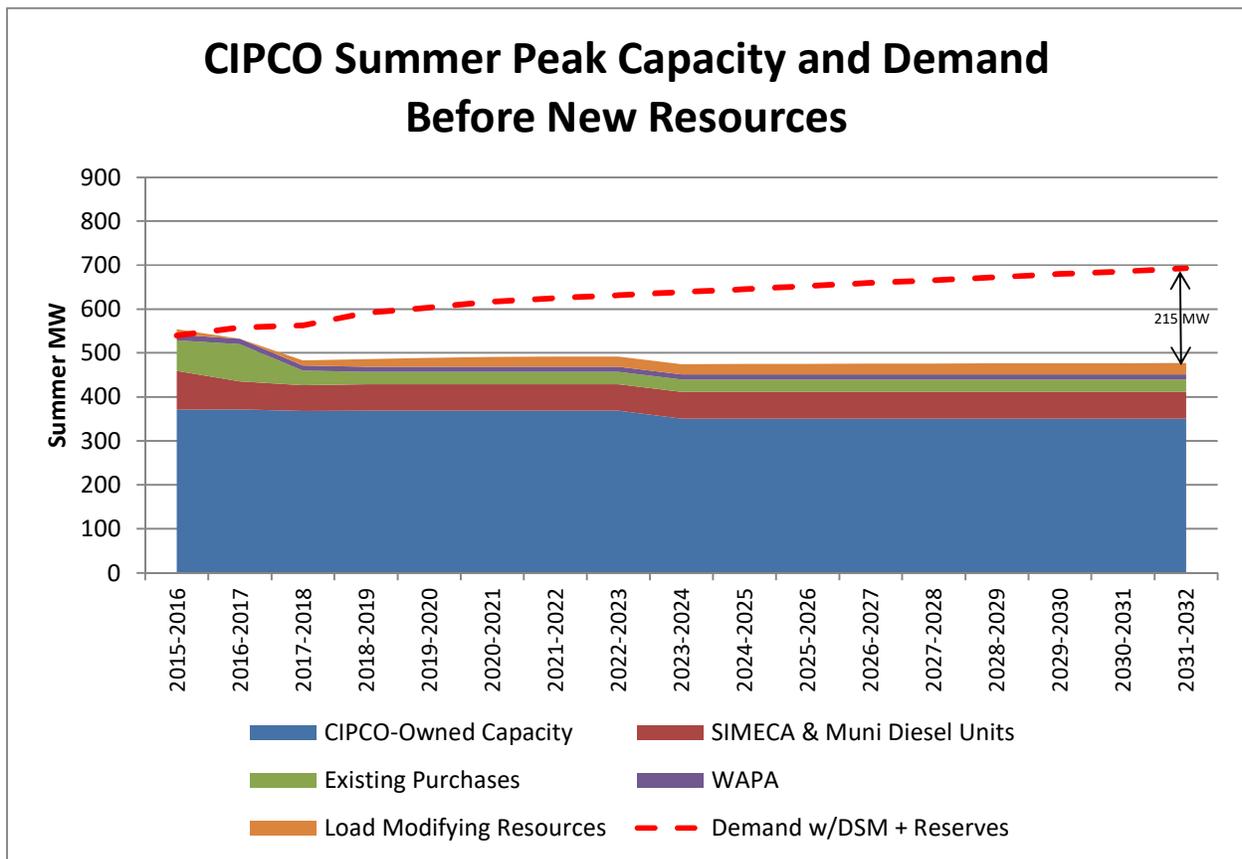


Table 4 – CIPCO Load and Capability BEFORE New Resources

CIPCO Load & Capability BEFORE NEW RESOURCES <small>Demands shown in MW</small>	2015-2016 2016-2017 2017-2018 2018-2019 2019-2020 2020-2021 2021-2022 2022-2023 2023-2024 2024-2025 2025-2026 2026-2027 2027-2028 2028-2029 2029-2030 2030-2031 2031-2032																
	554.7	567.2	574.8	574.8	602.8	616.4	630.6	637.9	644.1	650.7	657.7	664.1	670.7	677.3	684.4	691.7	698.1
Planning Year																	
Total Internal Demand w/DSM																	
Load Diversity w/MISO	50.3	48.3	52.5	52.9	54.1	55.3	56.0	56.5	57.1	57.7	58.3	58.8	59.4	60.1	60.7	61.3	61.8
Adjusted Net Internal Demand	504.4	518.9	522.3	549.9	562.3	575.3	581.9	587.6	593.6	600.0	605.8	611.9	617.9	624.3	631.0	636.8	643.1
MISO Module E Reserves	35.8	39.4	40.7	41.2	41.0	42.0	43.1	44.1	45.1	45.6	46.6	47.7	47.6	48.1	48.6	49.0	49.5
ZRC Obligation (demand with Reserves)	540.2	558.3	563.0	591.1	603.3	617.3	625.0	631.7	638.7	645.6	652.4	659.6	665.5	672.4	679.6	685.8	692.6
Capability (UCAP Values):																	
DAEC	116.1	115.0	112.7	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8
Walter Scott #4	74.9	74.3	78.1	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8
Walter Scott #3	77.0	77.2	76.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
Louisa	33.5	33.3	33.1	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
New Natural Gas Plant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Unit #2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Summit Lake	69.4	71.6	67.9	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4
SIMECA	75.1	50.0	46.6	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
Other Municipals	13.5	13.7	12.4	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Asset Based ZRCs (Net Generating Capability)	459.5	435.1	427.0	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7	428.7
Purchases:																	
Regulatory Capacity	55.5	52.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind Purchase	14.0	33.2	33.0	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
Solar Purchase	0.0	0.0	0.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
External Resource: WAPA	12.7	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Load Modifying Resources (Interruptible Loa)	12.3	0.0	11.3	17.2	19.8	22.4	22.7	23.1	23.4	23.7	24.0	24.4	24.7	25.0	25.3	25.6	25.9
NetZRCs (Adjusted Net Capability)	554.0	532.2	483.1	486.1	488.7	491.3	491.6	492.0	474.8	475.1	475.4	475.8	476.1	476.4	476.7	477.0	477.3
Surplus	13.8	-26.1	-79.9	-105.0	-114.6	-126.0	-133.4	-139.7	-163.9	-170.5	-177.0	-183.8	-189.4	-196.0	-202.9	-208.8	-215.3

The reserve percentage for 2015-16 was 7.1%; the reserve percentage for 2016-17 was 7.6%, and approximately 7.6% is assumed for the duration of the forecast. The MISO Module E-1 Load & Capability uses Unforced Capacity (UCAP) values which are the lowest installed capacity values for the year reduced by forced outage rates.

Chapter 4: Demand-Side Resource Options

DSM Objectives

CIPCO currently has a robust set of demand-side management (DSM) programs available to the retail consumers of its member systems, as summarized in Chapter 2. These programs offer information and incentives to help member-consumers lower their energy bills and reduce the overall amount of energy used within the CIPCO service area.

The DSM programs are designed to provide benefits to the CIPCO system exceeding the costs of implementing and offering those programs, from a societal perspective (total resource cost plus the assumed cost of externalities). The financial benefits of the energy and peak demand savings are compared to CIPCO's avoided cost of new generation or incremental supply-side resource acquisition. DSM measures and programs are added to CIPCO's resource portfolio if they can be offered and maintained for less than CIPCO's avoided energy and demand costs and are feasible from a technical, economic, and market perspective. Measures and programs that are more expensive than CIPCO's avoided costs or are in other ways infeasible are typically not offered, except for pilot testing purposes. Programs or specific measures that are not currently cost-effective may be implemented in the future if CIPCO's avoided costs increase above that of the program's projected expense and/or if the cost of the measures decline to a level at which they become cost effective.

Since the 1990s, CIPCO has conducted a comprehensive evaluation of DSM measures, programs, and delivery mechanisms on a regular basis. The DSM objectives and planning criteria are coordinated across the CIPCO system using a common set of methodologies and assumptions. CIPCO's current DSM plans are based on evaluations used to develop energy-efficiency goals that have been filed with the Iowa Utilities Board (IUB) as part of CIPCO's most recent five-year Iowa DSM Plan.

Evaluation Criteria

DSM measures and programs are evaluated from multiple perspectives using the following benefit-cost tests. These definitions are from the Iowa Administrative Code, and have been used to guide the cost-effectiveness testing:

Societal test means an economic test used to compare the present value of the benefits to the present value of the costs over the useful life of an energy-efficiency measure or program from a societal perspective. Present values are calculated using a 12-month average of the 10-year and 30-year Treasury bond rate as the discount rate. The average is calculated using the most recent 12 months at the time the utility calculates its benefit/cost tests for its Energy Efficiency Plan. Benefits are the sum of the present values of the utility avoided supply and energy costs including the effects of externalities (using a 10 percent externality adder, per Iowa Code). Costs are the sum of the present values of utility program costs (excluding consumer incentives), participant costs, and any increased utility supply costs for each year of the useful life of the measure or program.

Utility cost test means an economic test used to compare the present value of the benefits to the present value of the costs over the useful life of an energy-efficiency measure or program from the utility revenue requirement perspective. Present values are calculated using the utility's discount rate. Benefits are the sum of the present values of each year's utility avoided capacity and energy costs (excluding the externality factor) over the useful life of the measure or program. Costs are the sum of the present values of the utility's program costs, consumer incentives, and any increased utility supply costs for each year of the useful life of the measure or program. The typical cooperative ownership and organizational structure divides generation and transmission functions from retail sales of electricity with all-requirements contracts and wholesale rates connecting the two parties.

Participant test means an economic test used to compare the present value of benefits to the present value of costs over the useful life of an energy-efficiency measure or program from the participant's perspective. Present values are calculated using a discount rate appropriate to the class of consumer to which the energy-efficiency measure or program is targeted. Benefits are the sum of the present values of the consumer's bill reductions, avoided incremental equipment purchase costs, tax credits, and consumer incentives for each year of the useful life of an energy efficient measure or program. Costs are the sum of present values of the consumer participation costs (including initial capital costs, ongoing operations and maintenance costs, removal costs less a salvage value of existing equipment, and the value of the consumer's time in arranging installation, if significant) and any resulting bill increases for each year of the useful life of the measure or program. The calculation of bill increases and decreases accounts for any time-differentiated rates to the consumer or customer-class being analyzed.

Ratepayer impact measure test means an economic test used to compare the present value of the benefits to the present value of the costs over the useful life of an energy-efficiency measure or program from a rate level or utility bill perspective. Present values are calculated using the utility's discount rate. Benefits are the sum of the present values of utility avoided capacity and energy costs (excluding the externality factor) and any revenue gains due to the energy-efficiency measures for each year of the useful life of the measure or program. Costs are the sum of the present values of utility increased supply costs, revenue losses due to the energy-efficiency measures, utility program costs, and consumer incentives for each year of the useful life of the measure or program.

CIPCO and its member systems considered these tests to determine the cost-effectiveness of specific programs and to assure an equitable sharing of net benefits without excessive negative influences on any constituency. Additional discussion of the evaluation criteria and strategy can be found in the five-year Energy Efficiency Plan filed by Iowa's electric cooperatives in 2014⁸.

⁸ Iowa Association of Electric Cooperatives, "Electric Cooperatives' Joint Energy Efficiency Plan 2015-2019", December 31, 2014.

In addition to the aggregate net benefits, CIPCO uses additional criteria to evaluate DSM measures including:

- Load shape
- Participation factor
- Magnitude of energy and demand impact
- Public perception issues
- Availability of products and services
- Availability of delivery channel partners
- Marketing impediments
- Program costs and budget impacts

In addition to those criteria, consideration is given to particular measures and broader programs designed to deliver a set of measures, including:

- Key consumer characteristics that influence acceptance and response to targeted programs such as demographics, income, awareness, motivation, price, and up-front capital costs
- Key utility considerations affecting resource requirements
- Local conditions and other unique characteristics for a particular region or cooperative's service territory
- External variables such as economic conditions, energy prices, alternative technologies, regulation, and tax credits also influence consumer's decisions
- Utility considerations such as the load shape changes and their impacts on generation, transmission, and distribution system resources
- Local community or individual member cooperative considerations that may enhance or deter the promotion and delivery of specific programs

CIPCO and its member systems monitor and refine their DSM programs and delivery mechanisms on an ongoing basis to help improve the overall effectiveness of their programs. CIPCO holds several meetings a year where employees from the member cooperatives discuss local issues related to DSM programs offered by CIPCO. Based on these discussions and as changes are made to federal energy-efficiency standards, CIPCO and its members re-evaluate programs and make adjustments with the intent to improve their implementation and effectiveness.

Five-Year DSM Plan

In June 2007, the Iowa Utilities Board (IUB) Issued Docket NOI-07-2, ordering Iowa utilities to report their DSM activities and began a series of steps regarding regular DSM reporting and planning activities. This, in turn, led to a number of additional directives regarding DSM reporting and planning activities in Iowa. In response to new regulatory directives, the Iowa Association of Electric Cooperatives (IAEC) enhanced its efforts in coordinating the filings of all Iowa electric cooperative utilities on a joint basis. CIPCO's member distribution cooperatives have participated in those activities over the past several years.

In 2008, the Iowa Legislature passed Senate File 2386. SF 2386, in part, specified procedures for assessing the potential of energy and capacity savings and developing energy-efficiency goals for gas and electric utilities not subject to rate regulation by the Iowa Utilities Board (IUB), including electric cooperatives. This Senate File required the commencement of this assessment of potential to begin by July 1, 2008 and for a progress report to be filed with the IUB on or before January 1, 2009. The legislation provided that, "individual utilities or groups of utilities may collaborate in conducting the studies required . . . and may file a joint report or reports with the Board." The IAEC filed its initial report on December 31, 2009 and included energy-efficiency goals over the 2010 to 2014 time frame. A subsequent plan was filed in 2014 and covers the 2015 to 2019 time frame. This filing and the resulting plans and goals for CIPCO's 12 member distribution cooperatives are public documents and are available through the IUB, as previously cited.

In 2014, CIPCO contracted with Cadmus to conduct a "potential" study to determine the technical, economic, achievable, and programmatic energy-efficiency potential that might be realized in CIPCO's service territory for the 2015 to 2019 timeframe. Following the potential study, Cadmus worked with CIPCO to develop the current five-year Energy Efficiency Plan. The results of the Energy Efficiency Plan were used to help develop the 2015 to 2019 energy-efficiency goals that member systems filed with the IUB. CIPCO's current DSM plan includes the programs discussed in Chapter 2 of this report.

The energy-efficiency goals included in the IUB report have been updated through 2021 for the IRP analysis. Detailed energy impact estimates for each DSM program across the CIPCO system over the 2017 to 2021 period are included in Table 5 (before system losses), and are summarized in Figure 8. The estimates include the number of new participants by program and the cumulative energy impacts for each year, including impacts for measures impacted by fuel choice of electric appliances over alternate fuels. Fuel choice of high-efficiency heat pumps contributes to increases in winter electricity consumption and peak demand but decreases in summer consumption and peak demand and overall energy consumption (of all fuels, on a BTU basis).

Since CIPCO is a summer-peaking utility, the summer peak demand is the primary driver of new resource requirements, and is therefore a key focus of DSM impacts. CIPCO's *incremental* DSM efforts from 2017 to 2021 are projected to decrease its summer peak demand by nearly an additional five megawatts over that five-year period.

The decrease in the number of new participants in high-efficiency lighting programs over the 2017 to 2021 time frame should be noted in Table 5. This is largely due to the phase-out of these programs as new federal energy-efficiency standards require the use of lighting products that were previously promoted through DSM programs and incentives.

Table 5 – DSM Program Participation and Impacts 2017-2021

	Number of New Participants					Cumulative MWh Impacts (at retail meter)				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Residential Programs										
Heat Plus	58	56	35	35	35	10,770	11,208	11,560	11,833	12,105
Dual Fuel	0	0	0	0	0	6,481	5,267	4,237	3,247	2,091
Interruptible	0	0	0	0	0	927	639	448	327	217
Air Source Heat Pumps	429	478	521	554	571	20,100	21,415	23,057	24,736	26,458
Geothermal Heat Pumps *	720	781	744	770	1,022	43,974	45,779	47,635	49,436	50,989
Conventional Water Heater Program	0	0	0	0	0	38	7	0	0	0
Premium Quality Water Heater	690	656	623	592	562	10,057	8,494	6,909	5,348	3,831
Drain Water Recovery Pipe	4	5	6	7	8	(7)	(9)	(13)	(16)	(21)
Heat Pump Water Heater	277	306	335	362	393	(2,576)	(3,110)	(3,690)	(4,317)	(4,993)
All Electric Home	40	49	61	74	75	573	350	83	(178)	(305)
Heat Recovery Ventilation	133	127	122	139	138	(280)	(308)	(334)	(361)	(390)
Central Air Conditioners	785	769	753	737	720	(4,073)	(4,005)	(3,903)	(3,764)	(3,598)
Energy Star Clothes Washer	515	515	515	0	0	(2,674)	(2,723)	(2,717)	(2,623)	(2,444)
Energy Star Dishwasher	0	0	0	0	0	(1,030)	(1,012)	(964)	(886)	(780)
Energy Star Refrigerator	0	0	0	0	0	(702)	(695)	(678)	(654)	(618)
Freezer	0	0	0	0	0	(85)	(85)	(85)	(85)	(85)
Dehumidifier	0	0	0	0	0	(106)	(106)	(106)	(106)	(106)
Efficient Television	0	0	0	0	0	(319)	(319)	(319)	(319)	(319)
Electronic Recycling	1,100	1,100	1,100	1,100	1,100	(3,467)	(2,919)	(2,540)	(2,428)	(2,360)
Residential Indoor Lighting (# bulbs)	285,000	275,000	250,000	50,000	25,000	(32,100)	(30,043)	(24,889)	(19,397)	(14,747)
Outdoor Security Lighting	2,422	2,569	2,716	2,862	3,009	(3,466)	(4,022)	(4,609)	(5,251)	(5,798)
Energy Star Window Air Conditioner	0	0	0	0	0	(36)	(35)	(33)	(31)	(29)
Low Flow Aerators	92	94	103	105	107	(139)	(149)	(160)	(172)	(184)
Low Flow Showerheads	92	94	96	98	100	(420)	(447)	(475)	(504)	(533)
Water Heater Tank and Pipe Insulation	0	0	0	0	0	(15)	(15)	(15)	(15)	(15)
Residential Weatherization	77	49	19	0	0	(662)	(699)	(719)	(725)	(725)
ETS Space Heating	0	0	0	0	0	23	8	0	0	0
Residential Total						40,784	42,463	47,679	53,095	57,644
Business & Agricultural Programs										
Commercial Air Source Heat Pumps	96	100	100	100	100	1,026	1,101	1,178	1,257	1,337
Commercial Geothermal Heat Pumps	219	219	219	219	219	2,419	2,386	2,327	2,204	2,083
Commercial Heat Recovery Ventilation	50	50	50	50	50	(395)	(452)	(508)	(565)	(622)
Premium Motors	0	0	0	0	0	(20)	(20)	(20)	(20)	(20)
Variable Speed Drives	43	47	51	55	59	(3,709)	(4,035)	(4,390)	(4,764)	(5,000)
Commercial Indoor Lighting (# bulbs)	28,304	26,889	25,545	24,267	23,054	(24,037)	(25,816)	(27,162)	(28,184)	(29,035)
Dairy Pre-Cooler	8	8	8	8	8	(750)	(763)	(735)	(678)	(641)
Livestock Ventilation Fans	101	101	101	101	101	(289)	(329)	(370)	(410)	(451)
Livestock Circulation Fans	0	0	0	0	0	(139)	(139)	(139)	(139)	(139)
Livestock Equipment	175	150	150	150	0	(975)	(1,142)	(1,293)	(1,442)	(1,516)
Custom C&I	8	8	8	8	8	(9,034)	(13,365)	(17,695)	(22,025)	(26,355)
General C&I Total						(35,903)	(42,572)	(48,807)	(54,766)	(60,358)
CIPCO System Total						4,881	(109)	(1,128)	(1,671)	(2,714)

* The projection for geothermal heat pumps reflects a continuation of growth that has been aided with a generous federal tax credit. While the full impact from the tax credit is unknown, it is possible that the estimated participation and energy growth for this measure could be significantly lower if not renewed in 2017.

Cumulative electric energy impacts from all residential programs combined tend to be positive (electric load growth) due to the impact of fuel switching away from non-electric fuel choices to efficient electric heat pumps and water heating.

The cumulative impacts of all business and agriculture DSM programs tended to be very small compared to residential programs until 2010. After 2010, an increased focus was placed on electricity consumption reductions in both the residential and business sectors, including large expansions of business and agriculture programs and more aggressive energy savings goals.

In addition to DSM programs, CIPCO maintains an interruptible program for large C&I customers. There were 20 consumers on its Schedule A-2 interruptible rate in 2015 and another three of CIPCO's largest industrial consumers have long-term, three-party, interruptible sales contracts. The total potential interruptible load impact at the time of CIPCO's 2015 annual peak demand was approximately 12.0 MW (combined A-2 and Contract interruptible customers). CIPCO continues to pursue opportunities for interruptible contracts with existing or new large consumers, but future participation levels are uncertain and are conservatively estimated to increase to 24.3 MW by July 2035 for planning purposes.

Long-Term DSM Plan

Development of long-term load forecasts and resource plans requires an extended forecast of DSM impacts. For analysis purposes, the programs outlined in the five-year DSM plan are assumed to be extended over the planning horizon. In reality, the DSM program offerings may change as a result of program evaluation, updated avoided costs, expanding government regulations and energy-efficiency standards, technology advancements, and other new information.

Consistent with CIPCO's 2016 load forecast, the estimated cumulative impacts of historic and future DSM programs are integrated into the load forecasts that were presented in Chapter 3. The "base-case" load forecast includes the projected impacts of DSM programs over the load forecast and IRP horizon.

The estimated DSM impacts on CIPCO's total energy requirements are summarized in Figure 8, including an estimated 8.0 percent for distribution and transmission system losses beyond the estimated impacts at the retail meter.

The impacts of DSM programs on CIPCO's seasonal peak demands are also estimated on a program basis and are aggregated to the CIPCO level across programs. CIPCO's DSM strategy focuses on the summer peak demand, since it typically drives the CIPCO system peak demand and the annual MISO peak demand. The estimated summer peak DSM savings impact increases to approximately 25 MW by 2020, as illustrated in Figure 9.

Figure 8

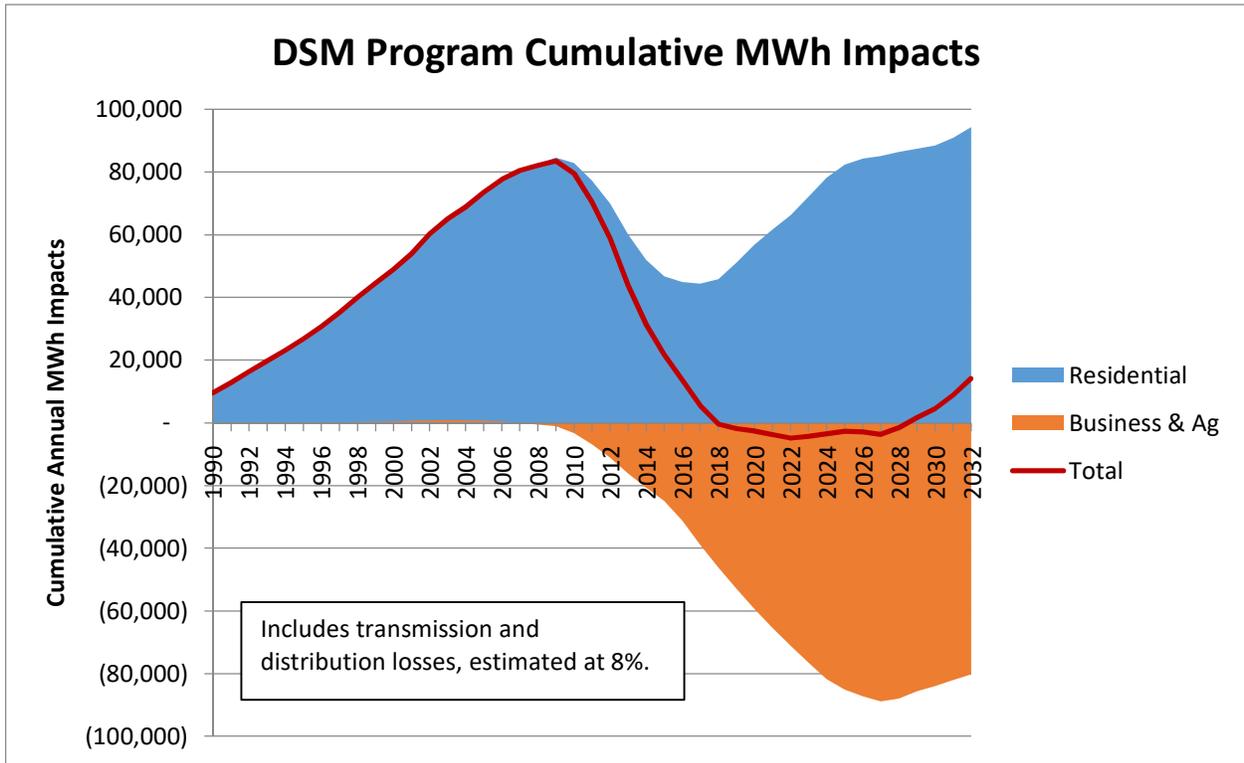
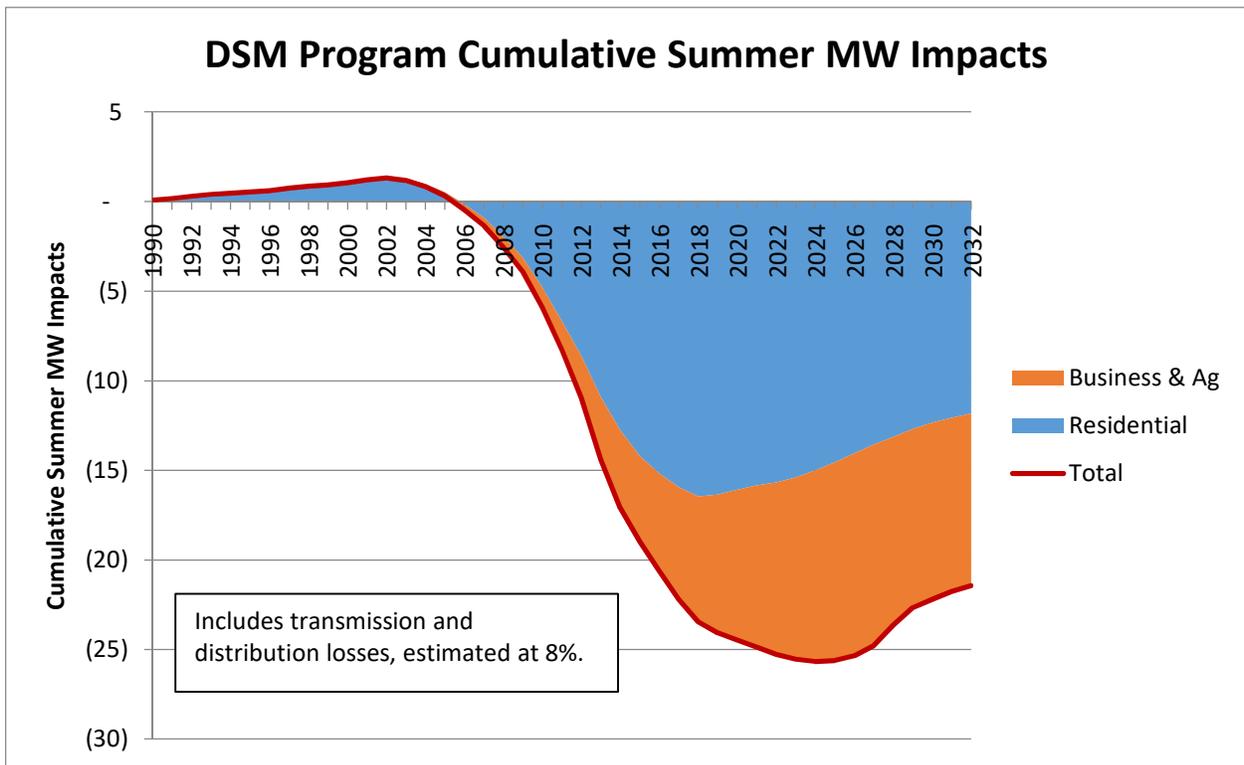


Figure 9



Verification and Durability

CIPCO has an established monitoring and verification process to ensure the installation and effectiveness of DSM measures. This process includes consumer surveys that accompany rebates provided to participants and ongoing appliance (end-use) surveys to update the current stock of appliances and to track changes over time. CIPCO uses the survey information to adjust assumptions in its DSM planning and evaluations, including assumptions about alternate fuel choices, uninstalled equipment, free ridership, and other factors that affect the impact of DSM measures.

Since CIPCO has been marketing energy-efficient equipment for several decades, it has an established database of measure installations, estimated impacts, and the anticipated lifetime of those measures. As those measures are retired (reach their anticipated lifetime), the impacts of those measures are removed from the cumulative DSM impact estimates used for planning purposes. In this manner, the measure impacts are included in a plausible and discreet time period, and are not double-counted with new measures being installed to replace retired measures. The impacts of measure retirements and new measure installation are evident in the long-term DSM impact estimates presented in this section.

Chapter 5: Supply-Side Resource Options

CIPCO's existing owned generation resources and long-term power purchase contracts currently meet the majority of the CIPCO system's needs. The remaining portions of energy and demand requirements are met through a combination of short-term contracts and market power purchases. CIPCO maintains a strategic long-term guideline to meet a minimum of 85 percent of system energy needs through owned generation and long-term power purchase contracts, and is currently well within that threshold.

Options to meet the future needs of the CIPCO system include one or a combination of the following:

- Expand DSM programs to reduce power needs, as discussed in the previous section
- Construct or partner in development of new generation resources
- Purchase supplemental capacity and/or energy resources through wholesale contracts

New Generation Options

CIPCO continually monitors its need for additional resources and the opportunities available within the regional wholesale power market. CIPCO's decision to pursue or not pursue specific new generation options will depend on a variety of factors, including:

- Its need for future resources and its load/resource balance relative to market exposure and risks
- The advantages of fuel diversity
- The ownership and partnership structures available
- The credit-worthiness and ratings of the entities involved
- Technical and price risks with different technologies or fuels (e.g. dispatchable vs. intermittent)
- The expected cost of generation over the life of the plant
- Available opportunities in the region for a particular resource
- Financing, regulatory, and environmental compliance risks
- Length of the project development, design, and construction periods

The capital, operating, maintenance, and fuel costs of each resource option will depend on the particulars of a specific resource, the technologies used, fuel availability and price, capital market conditions, environmental issues associated with the specific location, and any other advantages or disadvantages with a specific resource option. CIPCO monitors and evaluates options as they become available and seeks additional information where specific options are not readily available for evaluation.

The U.S. Department of Energy (DOE) develops an Annual Energy Outlook (AEO) to comprehensively evaluate and forecast several metrics of the energy industry over a long-term horizon. As part of the AEO evaluation, The DOE estimates current and future costs of new generation on a lifecycle basis. This provides a credible benchmark with which to begin evaluations of future resource additions. Estimated levelized costs of new generation are summarized in Figure 10 and in Table 6.

Figure 10

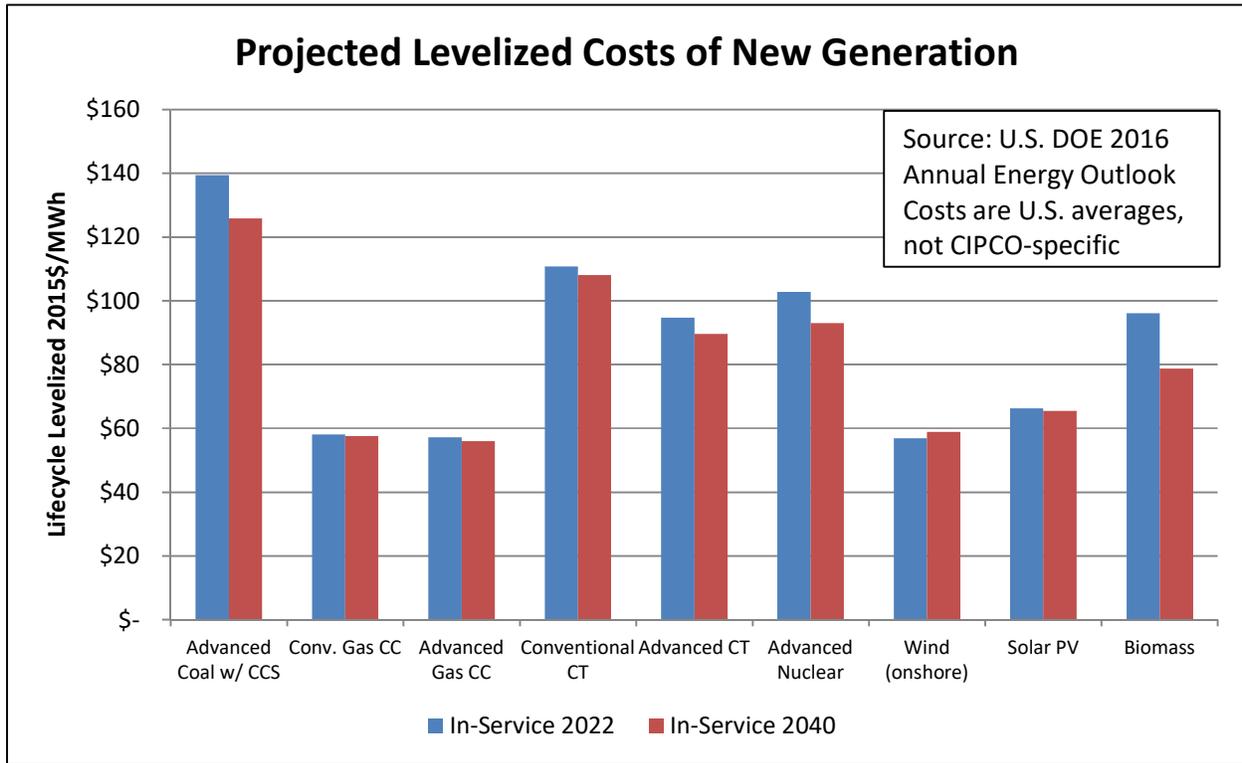


Table 6 – Levelized Cost for New Generation Resources

Estimated Levelized Cost Details for New Generation Resources, 2022

Plant Type	Capacity Factor (%)	U.S. Average Levelized Costs (2015 \$/megawatthour) for Plants Entering Service in 2022 1/				
		Levelized Capital Cost	Fixed O&M	Variable O&M (incl. fuel)	Transmission Investment	Total System Levelized Cost
Advanced Coal with CCS	85	97.2	9.2	31.9	1.2	139.5
Natural Gas-fired						
Conventional Combined Cycle	87	13.9	1.4	41.5	1.2	58.1
Advanced Combined Cycle	87	15.8	1.3	38.9	1.2	57.2
Advanced CC with CCS	87	29.2	4.3	50.1	1.2	84.8
Conventional Combustion Turbine	60	40.9	6.5	59.9	3.4	110.8
Advanced Combustion Turbine	30	25.8	2.5	63.0	3.4	94.7
Advanced Nuclear	90	78.0	12.4	11.3	1.1	102.8
Wind	40	48.5	13.2	0.0	2.8	64.5
Solar PV ¹	25	70.7	9.9	0.0	4.1	84.7
Geothermal	91	30.9	12.6	0.0	1.4	45.0
Biomass	83	44.9	14.9	35.0	1.2	96.1
Hydro	58	57.5	3.6	4.9	1.9	67.8

1/ Costs are expressed in terms of net AC power available to the grid for the installed capacity.
Source: Energy Information Administration, Annual Energy Outlook 2016, April 2016, DOE/EIA-0383

The AEO comparisons indicate that the levelized cost of a combined-cycle gas turbine is less than one-half the price of an advanced coal plant with carbon capture and storage (CCS), while the cost of a gas-fired combustion turbine is two-thirds to three-fourths the price of a coal plant. Advanced nuclear compares favorably with coal but is more expensive than combined-cycle gas units on a levelized cost basis given current capital and fuel cost assumptions.

Among renewable power options, the cost of wind is comparable to a combined-cycle gas unit while solar is somewhat more expensive on a levelized cost basis for a U.S. average⁹. It should be noted that Iowa has some of the best wind resources in the United States, while it has relatively average solar resource potential compared to the U.S. average. Although the levelized costs of geothermal and hydro utility-scale generation is comparable to the cost of natural gas generation, Iowa has no available large hydro or geothermal opportunities. Iowa does have ample biomass resource potential should the prices become more favorable to the current AEO expectations.

It should be noted that these are general assumptions across the U.S., not specific to the CIPCO system or any options currently being evaluated, but provide reasonable comparisons for general discussion.

New Coal Plant Options

Coal comprised approximately 40 percent of CIPCO's sources of energy in 2015, but that share will decline in the future as non-coal resources are added to CIPCO's generation portfolio. CIPCO's last coal resource addition was the acquisition of partial ownership of the Walter Scott Jr. #4 unit near Council Bluffs, operated by MidAmerican Energy. CIPCO initially acquired 73 MW of capacity upon plant completion in 2007, and purchased an additional four MW in 2011.

Although the price of power from many existing, large coal power plants remains competitive in the regional power market, the marginal cost of production from new natural gas-fired generation is much lower than for new coal plants, as discussed in the previous section. This is partially due to the greater capital cost for coal plant construction, current fuel price projections, and emissions abatement needs and environmental compliance costs associated with coal generation.

Due to the combination of these factors, development of any new coal generation resources in the region is unlikely in the foreseeable future. Although CIPCO will continue to monitor the market for next-generation coal plants or for low-cost ownership options for existing plants, it has no firm plans to pursue additional coal generation resources within the 15-year IRP horizon.

New Nuclear Plant Options

The Next Era Energy Duane Arnold plant provided over one-third of the CIPCO system's energy in 2015 and comprises over 20 percent of the capacity available to the system. This carbon-free and emission-free resource is a key part of CIPCO's strategic goal to balance fuel supply and mitigate emissions. The Duane Arnold plant operates under strict oversight and regulation of the Nuclear Regulatory Commission (NRC) and is committed to safe and responsible operation and handling of nuclear fuel.

⁹ Costs are provided excluding incentives

CIPCO continues to monitor the development of advanced nuclear power plants in the United States. However, there are no firm plans for new nuclear plant construction in the Midwest at this time, and none are likely in the foreseeable future. CIPCO is prepared to evaluate the merits of new nuclear generation, should it be proposed. Since new nuclear plants take eight to ten years to plan, design, approve, and construct, it is unlikely that any new nuclear capacity would be added in this region until near the end of this 15-year IRP horizon. Should CIPCO pursue participation in future new nuclear plant, it would likely serve to eventually replace CIPCO's power from Duane Arnold after its license expires in 2034 rather than serve as an incremental resource addition.

New Natural Gas Plant Options

CIPCO's Summit Lake Plant, on-line since 1952, provides 70 MW of summer regulatory capacity to the CIPCO system and is its only gas-fired, central-station generation plant. As a peaking plant, Summit Lake comprises a substantial portion of CIPCO's regulatory capacity, but only a small share of CIPCO's overall energy needs.

Natural gas has substantial environmental benefits compared to coal. Natural gas plants do not emit mercury, SO₂, or particulates to any great extent, and have lower emissions of NO_x, CO, and CO₂ per unit of energy generated compared to coal generation. There are no ash disposal or coal dust issues with generation or fuel transportation, although the natural gas combustion and transmission process may allow small amounts of methane, a potent greenhouse gas, to escape.

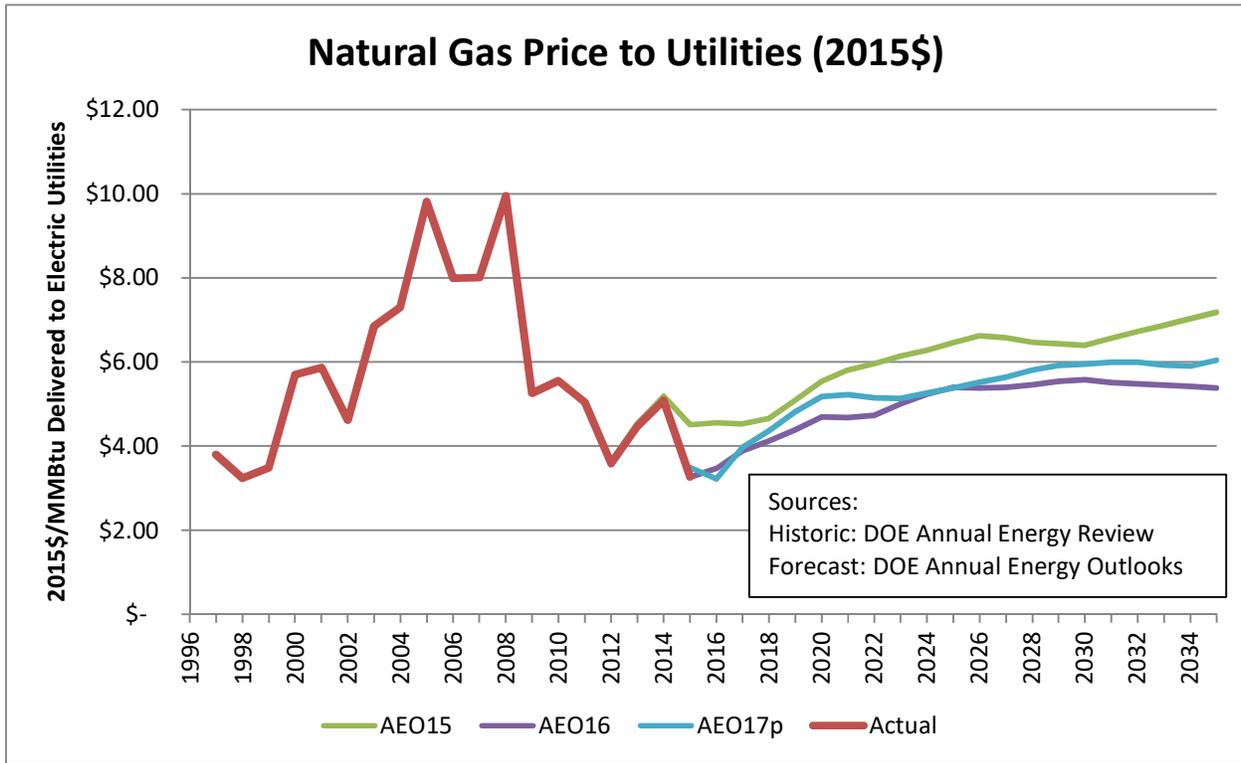
In addition, natural gas plants have the advantage of typically being planned, designed, approved, and constructed in three to five years. This is much shorter than the typical coal or nuclear power plant, and allows greater planning flexibility while reducing the financial risks of longer construction cycles.

Advances in natural gas recovery techniques, particularly in hydraulic fracturing (aka "fracking") have resulted in vast quantities of previously unrecoverable natural gas resources being available for extraction in a cost-effective manner. In addition, recent new resource discoveries within the United States have further bolstered the potential future availability of natural gas. The combination of substantial supply increases, continued production efficiencies, and the substantial capital invested in fracking infrastructure over the last decade have caused natural gas prices to remain low in recent years.

The 2017 AEO forecast¹⁰ for natural gas prices delivered to U.S. electric generators, illustrated in Figure 11, is substantially lower than the 2015 AEO forecast due to the robust supply outlook, although it is slightly higher than the 2016 AEO forecast. It should be noted that the AEO forecasts were developed before the very large shale gas reserve discovery in western Texas that was announced in November 2016. This should further bolster long-term natural gas reserves and may exert further downward pressure on long-term gas prices. The current forecast for natural gas prices remains below \$6.00 per MMBtu over the IRP forecast horizon, adjusted for inflation.

¹⁰ Preliminary 2017 AEO released January 5, 2017. www.eia.gov/outlooks/aeo/

Figure 11



As noted earlier, new natural gas combined-cycle plants have a significant cost advantage over new coal or nuclear plants for baseload or intermediate power needs due to lower capital costs and relatively low natural gas prices. In addition to the cost advantages, gas-fired plants have superior load-following capabilities compared to coal or nuclear, and therefore complement CIPCO’s portfolio of intermittent wind and solar resources. For these reasons plus fuel diversity, CIPCO will continue to explore opportunities for co-ownership of a combined-cycle gas plant in the region.

CIPCO is currently considering the installation of smaller, simple-cycle, gas-fired generating units. These flexible and efficient units would provide regulatory capacity and supplemental power, with limited run times, at a reduced capital cost compared to a larger unit. An additional advantage of these units is the ability to disperse the units geographically, potentially improving system reliability and reducing the need for transmission and distribution system upgrades. Adding capacity in small increments also allows CIPCO to increase supply in proportion to load growth, helping it smooth costs over time. CIPCO’s current financial plan includes the addition of 50 MW of geographically-dispersed gas generation in 2020 and approximately 25 MW increments in selected future years, as needed. The small capacity increments and the relatively short installation lead-time provides CIPCO with added schedule and planning flexibility.

Cogeneration and District Heating and Cooling Options

Cogeneration and district heating provide substantial additional efficiencies by using “waste” heat (steam) from power production to heat or cool buildings. The heating or cooling fuel is essentially free (on an incremental basis), although infrastructure must be added to capture waste heat from the plant and distribute the heating or cooling capacity to buildings or processes.

Although cogeneration provides substantial energy efficiencies, its applications are limited due to geography and limited partnership opportunities between utilities and host facilities (the users of the heating or cooling capacity). A cogeneration power plant needs to be located in close proximity to the steam host, an equitable cost sharing plan needs to be negotiated, and the economic viability of both the power plant and the steam host needs to be ensured over an extended period.

CIPCO has robust information about the large commercial and industrial customers on its system through its load forecasting and customer relations processes and will continue to monitor opportunities to realize the joint benefits of cogeneration in the future. However, no cogeneration opportunities are currently available, and none are under formal consideration at this time.

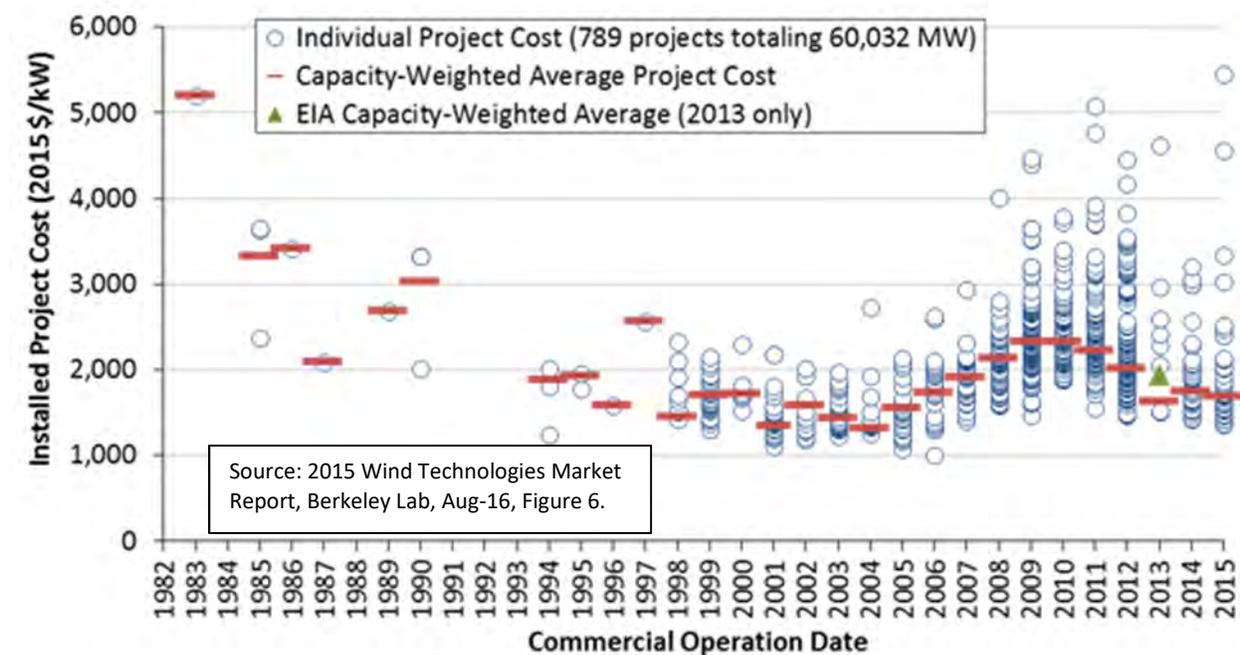
New Renewable Power Options

As noted previously in this report, CIPCO has made substantial investments and acquisitions of renewable power over the past decade. Renewable power is generally considered the most environmentally benign form of power generation since air emissions from wind and solar generation are zero. Landfill gas burns methane, a potent greenhouse gas, although emissions of NO_x and CO₂ remain. Biomass generation typically avoids the SO₂ and mercury emissions of coal, and produces no net CO₂ emissions, but it emits particulates and requires ash disposal.

The price of wind power has declined over the past few years and remains below \$2,000 per kW installed. While this price can vary widely by size and location, Iowa has a well-developed wind industry and larger wind farms that capture economies of scale and help reduce installed costs. Trends of wind power project costs in the U.S. are illustrated in Figure 12.

Figure 12

Installed Cost of U.S. Wind Power

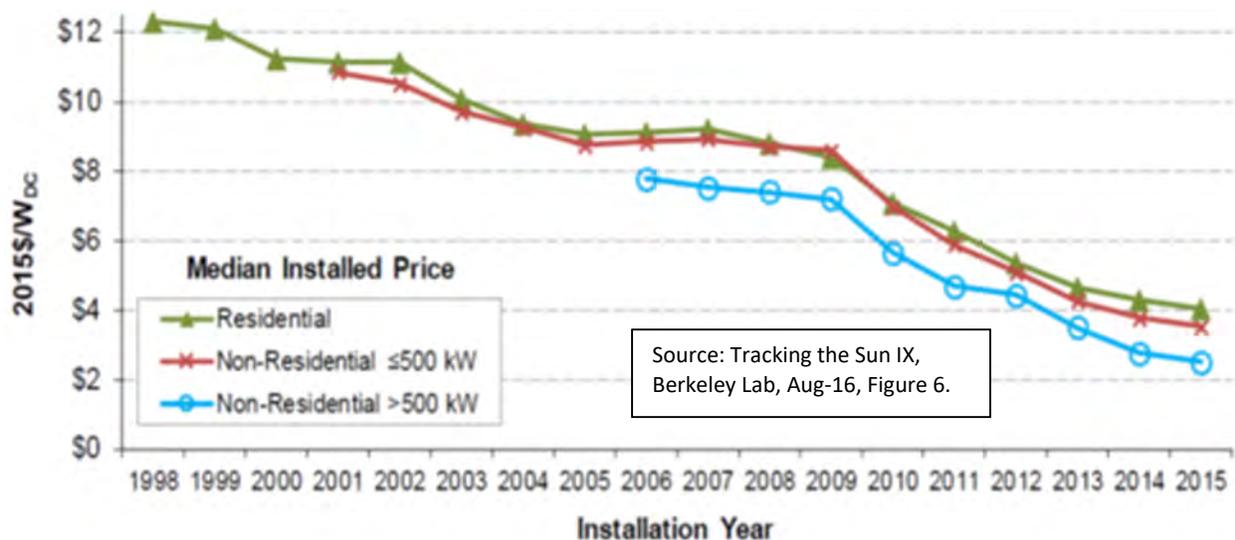


In addition to adding emissions/carbon-free energy to the CIPCO system, development of wind power provides jobs in Iowa and provides economic benefits to rural landowners, many of which are customers of CIPCO member systems.

The price of solar power has also decreased dramatically over the past decade, and is currently approaching \$2.00 per Watt_{DC} installed for utility-scale installations and around \$4.00 per Watt_{DC} for residential on-site units, as illustrated in Figure 13.

Figure 13

Installed Cost of U.S. Solar Power



CIPCO continues to consider additional opportunities to acquire wind, solar, landfill gas, and biomass resources. It currently has plans to add the following over the next several years:

- Install approximately 6.0 MW_{AC} of solar in 2017 as “Phase II” of its current solar strategy
- Add approximately 100 MW of new wind resources beginning in 2019

Any additional renewable power acquisitions in the near term will be opportunistic based on the specific credentials and the costs and benefits of particular projects.

Power Purchase Options

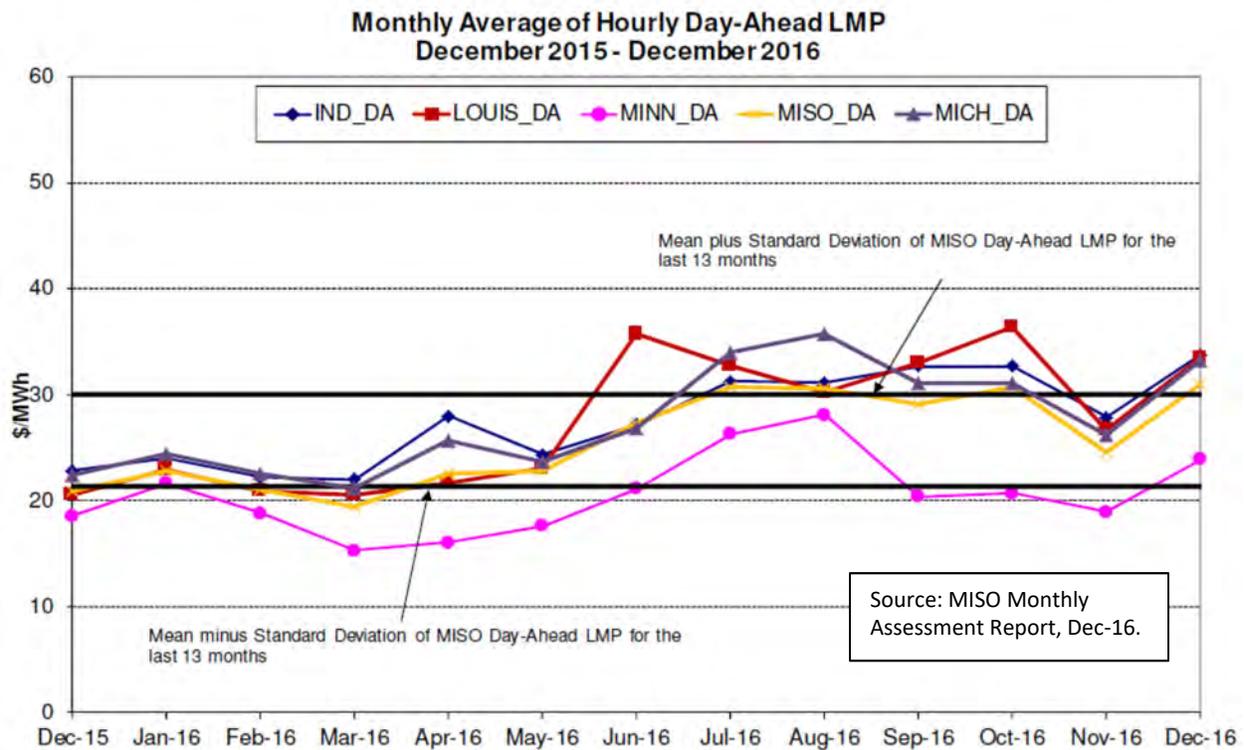
CIPCO currently meets a small share of its total power requirements through a variety of short- and long-term power purchase agreements (PPAs), as discussed previously. These PPAs allow CIPCO to meet its needs while partially mitigating the risks of plant ownership and providing price certainty. For these reasons, CIPCO intends to continue to meet a minority of its future needs through PPAs. However, CIPCO does not intend to over-rely on PPAs as they may leave CIPCO vulnerable to sharp wholesale market price swings and/or the possibility that new PPAs will be unavailable at the time that others expire. In addition, CIPCO manages counterparty PPA risk by considering ownership of new capacity resources.

MISO coordinates a regional wholesale power market and publishes wholesale power prices on an hourly, daily, and monthly basis. Wholesale power prices have remained historically low over the past

several years and show no signs of increasing significantly. The current availability and low prices of natural gas combined with slow regional load growth contribute to low wholesale power market prices, and those drivers are likely to persist into the foreseeable future.

As illustrated in Figure 14, the average monthly wholesale power price in the MISO region has generally remained in the \$20 to \$40 per MWh range in 2016 (excluding ancillary services) across most MISO regions, excluding the Minnesota trading hub. It should be noted that the price and availability of spot wholesale power is highly uncertain and leaves purchasers exposed to changes in the market and is therefore not necessarily the best indicator of long-term price trends.

Figure 14



CIPCO is a member-owner of ACES, headquartered in Carmel, Indiana. CIPCO joined ACES in 2007 to strengthen its risk management process and take advantage of the many services beneficial to CIPCO. ACES offers a wide variety of services including power trading and market monitoring, portfolio management, renewable energy credit trading, risk management and training, counterparty credit evaluation, and regulatory policy guidance. ACES services have helped CIPCO better manage power procurement, risk management, and long-term power planning.

ACES helps CIPCO assess future energy and capacity prices for incorporation into its financial forecasts and strategic plans. Based on a current assessment of regional power prices, the price for additional capacity is anticipated to remain low for the next several years due to the amount of excess capacity

available in the region. MISO's projected reserve margin was 18.0 percent in 2016¹¹, based on normal weather assumptions. This remains above its reference reserve margin of 15.2 percent and indicates a moderate level of excess capacity in the region, despite many plant retirements in recent years. This remaining reserve margin will be absorbed slowly due to very modest growth in electricity demand.

The price of capacity is projected to rebound in the 2020 timeframe and then increase for a few years thereafter before flattening. Although medium-to-long-term capacity costs are expected to increase as current excess capacity slowly shrinks, the projected price of market capacity purchases remains below the cost of a new gas-fired combustion turbine into the foreseeable future. This indicates little incentive to build large-scale merchant peaking capacity except where it is needed for local reliability reasons.

CIPCO also uses data provided by ACES as the basis for its market energy price forecasts. The forecast developed for CIPCO planning purposes uses ACES daily forward energy price curves developed across a 21-business-day period in October 2016. The mean of the forecasts for these days was calculated to produce forward price curves for on-peak periods and for around-the-clock (24/7) periods on a monthly basis through 2040.

ACES predicts that the cost of wholesale energy is expected to remain relatively low in the short-term due to excess capacity and relatively low natural gas prices. After 2021, the wholesale price of electricity is expected to increase more sharply, consistent with the capacity price forecasts, until the on-peak energy price forecast approaches or exceeds the estimated levelized cost of new combined cycle units.

These forward price curves are used to guide the trajectory of CIPCO's long-term avoided energy costs for integrated resource planning purposes, which are discussed in more detail in Chapter 6.

Transmission Options

Transmission resources alone cannot supply capacity or energy, but they have the potential to relieve congestion, allow access to more competitively-priced supply resources beyond CIPCO's immediate footprint, and reduce locational marginal prices (LMP) for purchased power.

As a market participant in the MISO system, CIPCO can take advantage of competitively priced power from across the MISO footprint. Expansion of the regional transmission grid may provide CIPCO access to lower-cost resources in the future, although grid expansion decisions are beyond the sole control of CIPCO. CIPCO participates in MISO planning activities and will continue to monitor future developments to assess potential impacts on supply resource availability and the potential price impacts of future transmission investments.

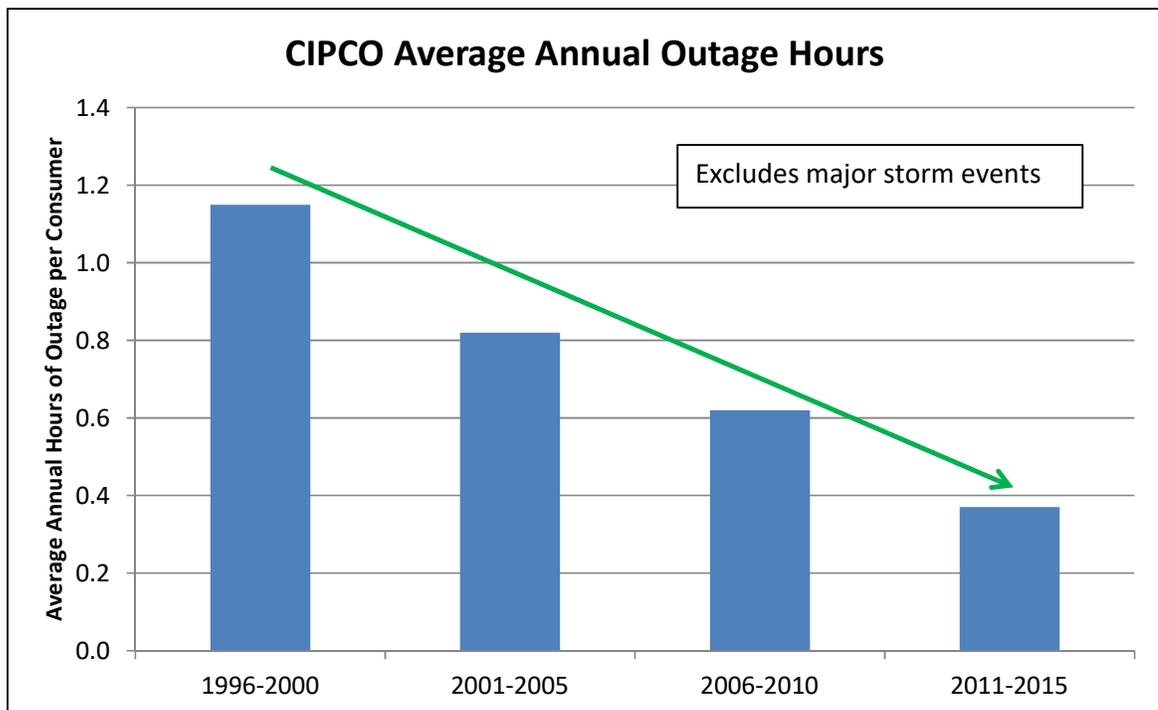
CIPCO's transmission system activities are intended to keep pace with industry standards and to meet or exceed Rural Utilities Services (RUS) guidelines. CIPCO adheres to a generally accepted "cooperative standard", and its planning and work programs are much like that of other cooperatives across Iowa. Transmission system upgrades and maintenance are ongoing efforts with goals that remain much the same from one planning period to the next.

¹¹ NERC 2016 Summer Reliability Assessment, May 2016

The availability of reliable transmission access will enhance CIPCO’s power supply resource options. CIPCO will continue to pursue the following important transmission-related activities as part of its integrated resource plan and ongoing operations processes.

- Support and monitor transmission access and usage rulings, such as FERC Orders 888 and 889 issued in 1996 and 1999, respectively. CIPCO supports and monitors the developments associated with open access rulings and actively participates in providing and purchasing transmission services.
- Monitor trends impacting the regional power industry and maintain a strong presence in the Midwest Reliability Organization (MRO) and MISO. CIPCO representatives participate in committees involving the following activities: management, regional transmission, regional reliability, power and energy marketing, computer model building, accreditation, transmission schedules and compensation, and sub-regional planning activities.
- Continue to meet the RUS guideline of one hour of outage per consumer per year or less. CIPCO’s commitment to reliability and service quality is reflected in its 0.37 average hours of transmission outage per consumer per year excluding major storms over the 2011 to 2015 period. This compares to average outage rates of 0.62 over the 2006 to 2010 period, 0.82 over the 2001 to 2005 period, and 1.15 over the 1996 to 2000 period. The declining outage rate illustrated in Figure 15 supports CIPCO’s commitment to ongoing system replacements, upgrades, expansion, and maintenance programs.

Figure 15



- Continue to improve the efficiency of its transmission system and work with its distribution member systems to improve system efficiencies through low-loss transformers and other equipment upgrades.
- Coordinate with its member systems on construction work plans and infrastructure improvements. It is anticipated that all 12 member rural electric cooperatives will complete construction work plans within the next five years.
- Continue to participate in joint transmission operations and maintenance activities with neighboring entities, primarily ITC and MidAmerican Energy Company. Joint transmission operations and maintenance activities include, but are not limited to:
 - Regular and special substation maintenance, e.g., protective relaying, Doble testing and infrared thermal scans
 - Pole ground-line treatment
 - Major line maintenance, i.e., hardware tightening, cross-arm replacements and retying conductors
 - Special line maintenance, e.g., replace arresters, install ground rods and mid-span spacers
 - Switch maintenance and inspection
 - Right-of-way clearing
 - Resistivity measurements of grounding connections
 - New-to-Replace-Old program (systematic efforts to rebuild older portions of the transmission system at voltage levels of 34.5, 69, and 161 kV)
 - Breaker New-to-Replace-Old program with a focus on eliminating aging oil-filled breakers

Chapter 6: Preferred Resource Plan

CIPCO's long-term strategic guideline is to supply at least 85 percent of its energy needs using owned resources plus long-term PPA commitments and to acquire no more than 15 percent of its needs from other sources. This guideline, combined with the resource needs identified in Chapter 3, determine the amount of resources that CIPCO needs to acquire over the IRP planning horizon.

CIPCO's preferred resource plan is selected from the demand- and supply-side options discussed in the previous chapters. The resource options are evaluated on a consistent basis using benefits and costs, risk management, and other criteria that meet the objectives of this IRP and achieve CIPCO's strategic goals. The resource evaluation and selection process, the assessment of environmental impacts, the resulting preferred resource plan, and contingency alternatives are discussed in the remainder of this chapter.

Integrated Resource Evaluation

Integrated resource evaluation involves comparing demand-side and supply-side resource options to meet CIPCO's future power needs in a reliable and cost-effective manner, consistent with the objectives of integrated resource planning. The process involves these primary steps:

- Forecast CIPCO's avoided energy and capacity costs
- Determine the amount of cost-effective DSM achievable given the avoided costs and other factors
- Select the preferred combination of new supply-side resources to meet the remaining power needs

In this manner, resources are treated in a consistent manner and the preferred resources are selected from the various demand- and supply-side options discussed in the previous chapter.

Avoided Costs

CIPCO's avoided cost of capacity and energy are the costs associated with acquiring incremental supply resources. Demand-side programs that can be implemented for less than CIPCO's avoided cost of power (including system losses and externalities) are cost-effective and are added to CIPCO's resource mix. CIPCO's future avoided cost estimates are developed using the ACES forward price curves for MISO Zone 3 capacity and for MISO energy, as discussed in Chapter 5. CIPCO's avoided costs for the purposes of DSM evaluations also include transmission and distribution energy and demand losses and externalities costs.

Avoided energy costs remain relatively flat for the next several years due to relatively low natural gas prices in the MISO footprint. Avoided capacity costs increase over time due to anticipated unit retirements contributing to the erosion of excess power supply in the MISO region.

These avoided costs are used as the basis for evaluating the cost-effectiveness of CIPCO's energy-efficiency programs. The impacts of externalities are added to delivered energy cost in program evaluations to recognize additional societal costs not embedded in the avoided cost of generation. In accordance with IUB rules and guidance, a 10 percent externality adder is applied to represent external costs associated with power production. In this manner, demand-side resource options are evaluated on a basis that is consistent with supply-side resource options with regard to meeting the future power needs of the CIPCO system.

Selected Demand-Side Resources

As discussed previously, CIPCO has a broad spectrum of energy efficiency and interruptible power programs that are cost-effective from a total resource cost perspective and provide benefits to the member-owners of CIPCO's member systems. The DSM programs were evaluated against CIPCO's avoided costs and selected based on their cost-effectiveness. In this manner, the DSM programs are evaluated on a consistent and integrated basis with power supply alternatives using CIPCO's avoided costs.

Projections of DSM program impacts were presented in Chapter 4. These included detailed participation and energy projections for each of CIPCO's DSM programs over a five-year horizon and aggregate DSM impacts through the remainder of the IRP horizon. These DSM program impacts are already incorporated into the load forecasts that drive CIPCO's resource needs, as discussed in Chapter 3.

An additional advantage of DSM programs is that they can be planned, approved, developed, and begin operation within a few years compared to time frames of five or more years for central-station generation. Therefore, DSM programs provide additional planning flexibility in addition to meeting a significant portion of CIPCO's resource needs.

Selected Supply-Side Resources

CIPCO's DSM programs capture energy efficiencies and help reduce total energy consumption and peak demands among end-use consumers on the CIPCO system. Beyond cost-effective DSM, additional resource needs on the CIPCO system will be met with supply-side resources.

CIPCO continually monitors the regional market and engages other parties in discussions about potential new power supply resources. It also evaluates an array of power supply resources based on lifecycle costs and benefits, risks, environmental impacts, and a variety of other criteria. In recent years, the combination of modest load growth and relatively low regional market power prices has allowed CIPCO to avoid acquiring new central-station generation while enhancing its portfolio of wind, solar, and biomass resources. These factors are expected to persist into the foreseeable future, and will drive CIPCO's resource strategy over the next several years.

Based on CIPCO's analysis, the following power supply alternatives have been identified as preferred resource options over the next 15 years:

Increase Wind and Solar Power Purchases

CIPCO continues to increase the amount of renewable energy supplied to its system, especially wind power purchased through long-term power purchase agreements (PPAs) and distributed solar resources. The attributes and cost trends for utility-scale wind and solar resources were discussed in Chapter 5. The amount of wind and solar power is being increased for a variety of reasons, including:

- The declining cost of renewable power in recent years, particularly utility-scale solar power
- The proximity of renewable power to the CIPCO system and related economic benefits
- Increased fuel diversity and decreased fuel price risk across the CIPCO system
- Reduced environmental liabilities risk compared to other forms of generation
- Public acceptance of, and demand for, renewable energy

For these reasons, CIPCO believes that a strong emphasis on wind and solar power as part of its integrated resource plan provides cost-effective power supply, represents prudent risk management, and is a sound business decision.

CIPCO currently has plans to add the following resources in the next several years. Acquisition of these resources is in various stages of planning, negotiation, or construction.

- Install approximately 6.0 MW_{AC} of solar in 2017 as “Phase II” of its current solar strategy
- Add approximately 100 MW of new wind resources beginning in 2019

Landfill gas and other biomass resources will be considered based on availability and cost, although no opportunities to purchase new biomass power are known at this time.

Add Peaking Capacity with Load Following Capability

The continued expansion of intermittent resources on the CIPCO system and in Iowa has increased the need for rapidly-dispatchable resources to provide power in real time when wind or solar generation temporarily declines. This “load-following” capability will have increasing value as the amount of wind and solar resources expands in the region. For this reason, and to meet CIPCO’s capacity requirements in its power pool and the MISO region, CIPCO plans to begin adding smaller, natural gas-fired generation beginning in 2020. The advantages of this approach include:

- Low capital cost compared to larger combustion turbines or other peaking generation
- Relatively low emissions compared to diesel reciprocating engines
- The ability to “load follow” (increase or decrease generation quickly) in response to changing conditions on the power grid, such as changing intermittent generation
- Relatively short lead times for permitting and placement, providing CIPCO with substantial planning flexibility and risk management advantages
- The ability to site units in distributed fashion across the system, providing system support, improving reliability, and potentially deferring future transmission and distribution investments

CIPCO's current financial plan includes the addition of 50 MW of gas generation in 2020 and increments of 25 MW in selected future years, based on identified needs. These blocks of generation will likely be geographically dispersed across the CIPCO system. This plan is flexible and will be adjusted based on CIPCO's changing generation and system needs. CIPCO's annual load forecasting and financial forecasting processes provide comprehensive updates of system needs, and will determine the magnitude and timing of specific generation additions.

Continue Limited PPAs

As noted previously, CIPCO's goal of obtaining the majority of its power supply from owned resources and long-term PPAs is an effective and prudent risk management strategy. CIPCO's guideline is to continue to purchase up to 15 percent of its needed power supply resources over the long-term to meet its needs and to manage its risks of plant ownership. Use of PPAs provides flexibility for CIPCO to plan its power supply resources relative to changing wholesale market price, fuel price, load growth, emissions limitations, or other risks that it may encounter. As noted previously, the projected low cost of capacity and energy over the next several years suggests that CIPCO may wish to purchase an increasing share of supplemental wholesale power in the short term until power supply needs and wholesale power prices dictate investment in new power resources.

Power Supply Summary

The addition of new wind and solar resources plus small, gas-fired generation and limited quantities of market power purchases will alter CIPCO's resource mix over time. The resulting resource plan provides a balanced and diversified strategy to meet the future power supply needs of its member systems in a cost-effective manner while mitigating exposure to fuel price volatility, environmental, and other risks.

CIPCO will derive an increasing share of its energy and capacity resources from wind, solar, and natural gas generation resources over the IRP planning horizon. As a result, the percentage share of power from nuclear, coal, and diesel resources will generally decline, although the capacity factors of coal plants will be impacted by wholesale market power prices that are beyond CIPCO'S control. The addition of the natural gas generation resources complements the increase in intermittent power on the CIPCO system by providing firm capacity and load-following capabilities.

As is evident in Figure 16 and Figure 17, and in Table 7 and Table 8, wind, solar, and other emission-free resources are contributing an increasing share of CIPCO's energy supply and will continue to increase over the IRP horizon. However, they only comprise a small portion of CIPCO's summer capacity obligations. Conversely, the addition of new natural gas generation and bilateral regulatory capacity purchases meet an increasing share of CIPCO's summer capacity obligations but a more modest portion of CIPCO's annual energy needs. CIPCO's energy and summer capacity supply-side resources over the 2015 to 2031 period are consistent with CIPCO's most recent financial forecast and are illustrated in the graphs and tables on the following pages.

Figure 16

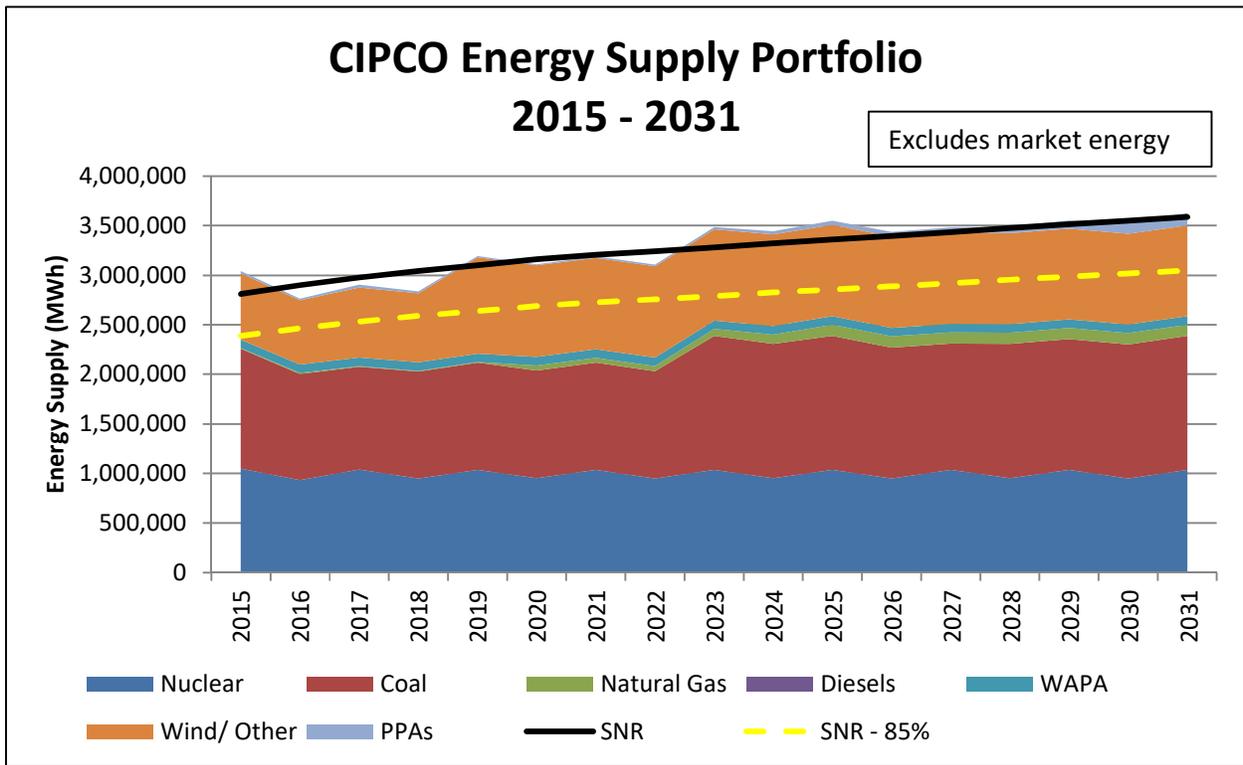


Figure 17

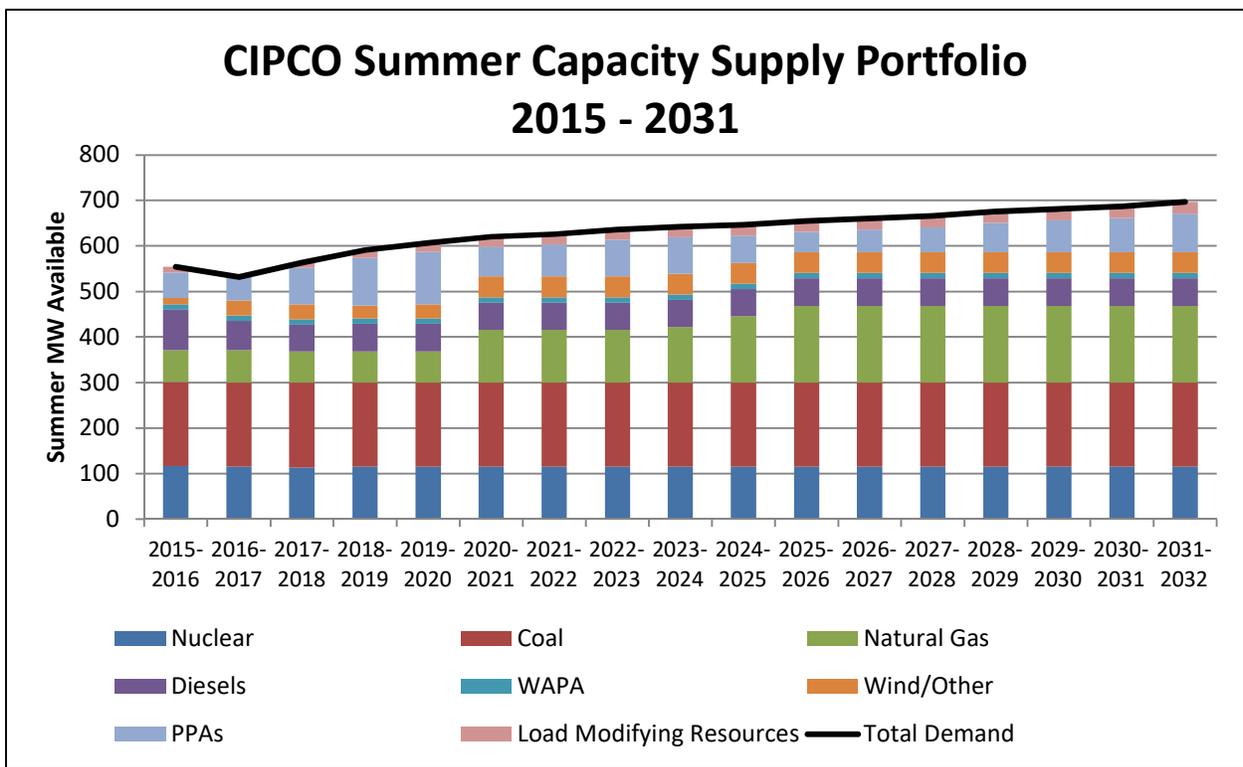


Table 7 – CIPCO Energy Supply Portfolio (MWh)

CIPCO Energy Supply Portfolio (MWh)								
<u>Year</u>	<u>Nuclear</u>	<u>Coal</u>	<u>Nat Gas</u>	<u>Diesels</u>	<u>WAPA</u>	<u>Wind/Other</u>	<u>PPAs</u>	<u>Total *</u>
2015	1,047,725	1,210,685	6,436	438	85,093	668,395	22,320	3,041,093
2016	933,980	1,068,922	10,752	410	85,359	649,027	14,880	2,763,330
2017	1,040,300	1,036,800	6,500	340	85,095	706,250	29,760	2,905,045
2018	947,600	1,081,200	6,500	339	85,095	697,660	18,600	2,836,994
2019	1,035,300	1,081,200	6,700	339	85,095	972,090	11,160	3,191,884
2020	953,700	1,084,900	50,700	340	85,360	924,590	11,160	3,110,750
2021	1,035,300	1,081,200	50,400	339	85,095	921,610	14,880	3,188,824
2022	950,700	1,081,200	50,500	339	85,095	921,480	18,600	3,107,914
2023	1,035,300	1,350,800	70,600	339	85,095	921,380	22,320	3,485,834
2024	953,700	1,354,800	92,400	340	85,360	924,120	33,480	3,444,200
2025	1,035,300	1,350,800	114,400	339	85,095	921,110	40,920	3,547,964
2026	950,700	1,318,500	114,400	339	85,095	921,010	48,360	3,438,404
2027	1,035,300	1,273,500	114,400	339	85,095	920,910	52,080	3,481,624
2028	953,700	1,351,900	114,600	340	85,360	918,410	63,240	3,487,550
2029	1,035,300	1,318,500	114,400	339	85,095	915,460	84,480	3,553,574
2030	950,700	1,350,800	114,400	339	85,095	915,330	106,440	3,523,104
2031	1,035,300	1,350,800	114,400	339	85,095	915,230	124,680	3,625,844

* Market interchange power is not included

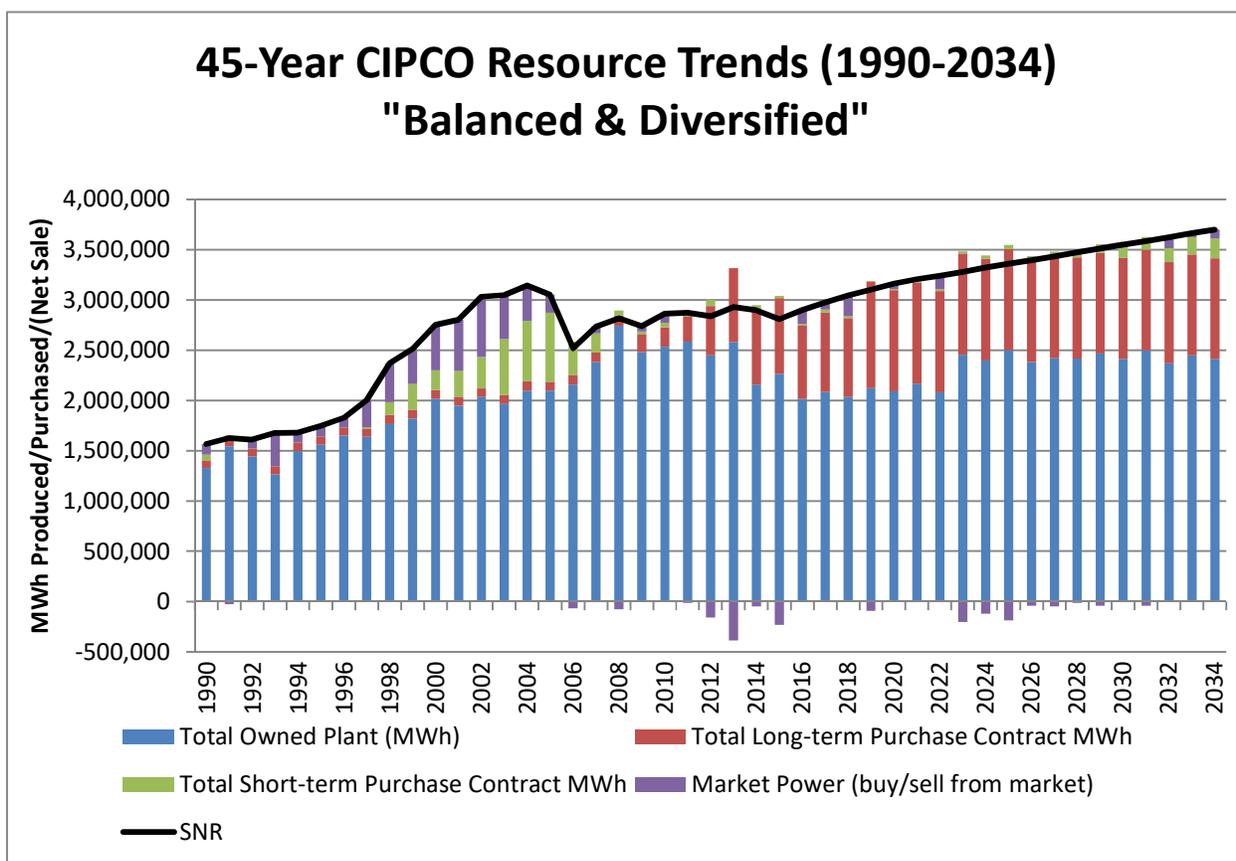
Table 8 – CIPCO Summer Capacity Portfolio (MW)

CIPCO Summer Capacity Portfolio (MW)									
<u>Plan Year</u>	<u>Nuclear</u>	<u>Coal</u>	<u>Nat Gas</u>	<u>Diesels</u>	<u>WAPA</u>	<u>Wind/Other</u>	<u>LMR</u>	<u>PPAs</u>	<u>Total</u>
2015- 2016	116.1	185.4	69.4	88.6	12.7	14.0	12.3	55.5	554.0
2016- 2017	115.0	184.8	71.6	63.7	11.8	33.2	-	52.1	532.2
2017- 2018	112.7	187.4	67.9	59.0	11.8	33.0	11.3	80.0	563.1
2018- 2019	114.8	185.3	68.4	60.2	11.8	28.4	17.2	105.0	591.1
2019- 2020	114.8	185.3	68.4	60.2	11.8	31.4	19.8	115.0	606.7
2020- 2021	114.8	185.3	115.5	60.2	11.8	45.4	22.4	65.0	620.4
2021- 2022	114.8	185.3	115.5	60.2	11.8	45.4	22.7	70.0	625.7
2022- 2023	114.8	185.3	115.5	60.2	11.8	45.4	23.1	80.0	636.1
2023- 2024	114.8	185.3	121.6	60.2	11.8	45.4	23.4	80.0	642.5
2024- 2025	114.8	185.3	145.2	60.2	11.8	45.4	23.7	60.0	646.4
2025- 2026	114.8	185.3	168.7	60.2	11.8	45.4	24.0	45.0	655.2
2026- 2027	114.8	185.3	168.7	60.2	11.8	45.4	24.4	50.0	660.6
2027- 2028	114.8	185.3	168.7	60.2	11.8	45.4	24.7	55.0	665.9
2028- 2029	114.8	185.3	168.7	60.2	11.8	45.4	25.0	65.0	676.2
2029- 2030	114.8	185.3	168.7	60.2	11.8	45.4	25.3	70.0	681.5
2030- 2031	114.8	185.3	168.7	60.2	11.8	45.4	25.6	75.0	686.8
2031- 2032	114.8	185.3	168.7	60.2	11.8	45.4	25.9	85.0	697.1

Capacities represent zonal resource credit

A long-term perspective of CIPCO’s historic and projected portfolio of power supply resources is illustrated in Figure 18. CIPCO meets the majority of its system resource needs with owned generation assets, supplemented with long-term, short-term, or market power purchases as needed and if cost-effective. As illustrated in Figure 18, CIPCO’s portfolio has included additional long-term purchase contracts in recent years, especially for wind power. Future solar and wind power purchases are reflected in the supply mix, along with increased coal plant output beginning in 2023 based on projected wholesale market prices resulting in increased capacity factors. This strategy is continued into the foreseeable future as CIPCO maintains a balanced and diversified portfolio of power supply resources.

Figure 18



CIPCO’s strategy to add smaller, fast-ramping natural gas generation aligns well with the changing energy landscape and MISO’s stated needs for the future. For CIPCO, the new units will provide responsive, flexible generation that pairs well with current and future intermittent resources. By dispersing these additions across the CIPCO service territory, the security of the entire system will increase. This strategy enables CIPCO to place generation in areas of need and to avoid other, more expensive, methods of improving reliability. Utilizing smaller, less-centralized generation units also spreads the capital costs of building new resources over a greater number of years. This allows CIPCO to manage its wholesale rate, remain competitive, and provide lower-cost services to its members.

Load and Capability

CIPCO files an updated long-term load forecast and resource capability with MISO in accordance with Resource Adequacy guidelines, at least annually. The load forecast report details CIPCO's load forecast, on both a firm and non-firm basis, and includes the impacts of DSM programs. Capability is included for CIPCO's available generators and resources that have been secured through contracts.

The load and capability report in Table 9 reflects the balance between expected power needs, including the MISO-required reserve margin, and resources and follows MISO's Resource Adequacy calculations. The amount of projected excess or shortfall over a long-term planning horizon is reflected and is consistent with the preferred resource plan identified in this IRP. The load and capability analyses incorporates expected load growth including the impacts of DSM programs and planned new power resources including PPAs. The load and capability indicates that CIPCO is expected to have some summer capacity surplus for the duration of the forecast (on a normal weather basis). Anticipated PPAs are added to keep supply and demand in relative balance over the 2017 to 2031 IRP planning horizon, as shown in Table 9. Future supply increases incorporate the key elements of the preferred resource plan, including continued implementation of CIPCO's extensive array of DSM programs, new PPAs for wind, solar, and other types of power, and the addition of small gas-fired generation units starting in 2020. As previously mentioned, the natural gas-fueled plants help fill CIPCO's need for firm capacity to complement CIPCO's acquisition of intermittent resources, while providing system reliability support and planning flexibility.

Table 9 – CIPCO Load & Capability

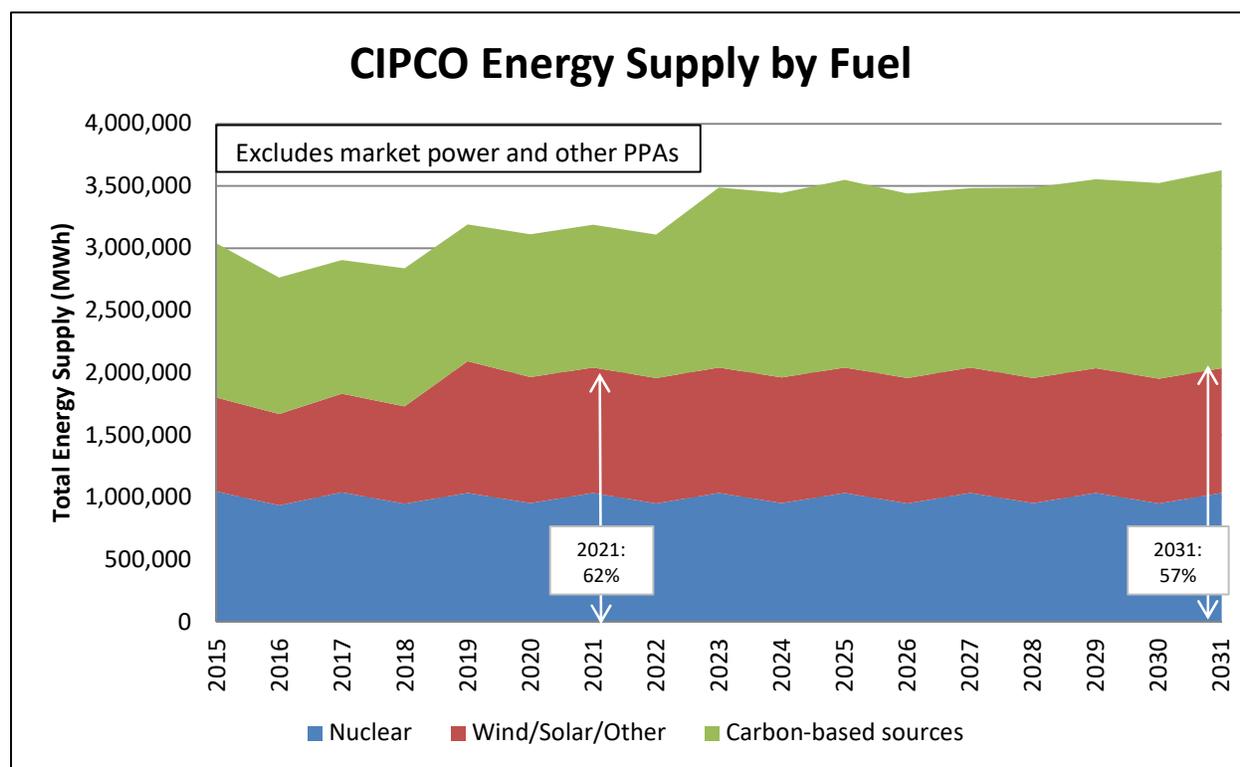
CIPCO Load & Capability Demands shown in MW		2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029	2029-2030	2030-2031	2031-2032
Planning Year		554.7	567.2	574.8	602.8	616.4	630.6	637.9	644.1	650.7	657.7	664.1	670.7	677.3	684.4	691.7	698.1	704.9
Total Internal Demand w/DSM		50.3	48.3	52.5	52.9	54.1	55.3	56.0	56.5	57.1	57.7	58.3	58.8	59.4	60.1	60.7	61.3	61.8
Load Diversity w/MISO		504.4	518.9	522.3	549.9	562.3	575.3	581.9	587.6	593.6	600.0	605.8	611.9	617.9	624.3	631.0	636.8	643.1
Adjusted Net Internal Demand		35.8	39.4	40.7	41.2	41.0	42.0	43.1	44.1	45.1	45.6	46.6	47.7	47.6	48.1	48.6	49.0	49.5
MISO Module E Reserves		540.2	558.3	563.0	591.1	603.3	617.3	625.0	631.7	638.7	645.6	652.4	659.6	665.5	672.4	679.6	685.8	692.6
ZRC Obligation (demand with Reserves)		116.1	115.0	112.7	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8	114.8
Capability (UCAP Values):		74.9	74.3	78.1	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8
DAEC		77.0	77.2	76.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
Waller Scott #4		33.5	33.3	33.1	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
Waller Scott #3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Louisa		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Natural Gas Plant		69.4	71.6	67.9	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4	68.4
New Unit #2		75.1	50.0	46.6	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
Summit Lake		13.5	13.7	12.4	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
SIMECA		459.5	435.1	427.0	428.7	428.7	475.8	475.8	475.8	475.8	505.5	529.0	529.0	529.0	529.0	529.0	529.0	529.0
Asset Based ZRCs (Net Generating Capability)		55.5	52.1	80.0	105.0	115.0	65.0	70.0	80.0	80.0	60.0	45.0	50.0	55.0	65.0	70.0	75.0	85.0
Purchases:		14.0	33.2	33.0	26.2	26.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
Regulatory Capacity		0.0	0.0	0.0	2.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Wind Purchase		12.7	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Solar Purchase		12.3	0.0	11.3	17.2	19.8	22.4	22.7	23.1	23.4	23.7	24.0	24.4	24.7	25.0	25.3	25.6	25.9
External Resource: WAPA		554.0	532.2	563.1	591.1	606.7	620.4	625.7	636.1	642.5	646.4	652.2	660.6	665.9	676.2	681.5	686.8	697.1
Load Modifying Resources (Interruptible Load)		13.8	-26.1	0.1	0.0	3.4	3.1	0.7	4.4	3.8	0.8	2.8	1.0	0.4	3.8	1.9	1.0	4.5
Net ZRCs (Adjusted Net Capability)																		
Surplus																		

The reserve percentage for 2015-16 was 7.1%; the reserve percentage for 2016-17 was 7.6% and approximately 7.6% is assumed for the duration of the forecast. The MISO Module E-1 Load & Capability uses Unbraced Capacity (UCAP) values which are the lowest installed capacity values for the year reduced by forced outage rates.

Environmental Assessment

CIPCO’s preferred resource plan contains a balanced mix of demand-side resources, wind and solar resources, and gas-fired generation that minimizes environmental impacts and risks compared to other alternatives. Acquisitions of new wind and solar energy, along with its nuclear investment and long-term purchase of WAPA hydropower, results in CIPCO’s 2021 total energy supply being comprised of approximately 62 percent carbon/emissions-free sources (excluding interchange purchases). As shown in Figure 19, CIPCO’s share of carbon/emissions-free energy production is projected to remain near 60 percent over the IRP planning horizon, despite growing energy needs. Note that interchange purchases are excluded from these calculations since the fuel source is unknown.

Figure 19



Compliance with current and future environmental requirements represents a highly important focal point for the CIPCO organization, and is an integral aspect of resource planning. Managing the risk exposure represented by environmental factors is accomplished through a combination of proactive strategies. These initiatives include use of lower emission-producing fuels (e.g., natural gas and lower-sulfur coal), substantial investments in carbon/emission-free generation, improvements in plant efficiencies, installation of advanced abatement equipment, and the prudent use of allowance markets.

Table 10 summarizes the capital-intensive environmental compliance actions CIPCO has already taken and additional efforts expected. Abatement actions are listed in the first column, with the mitigation target shown in the second column. The remaining columns indicate the coal plants where the actions were taken and which environmental regulations were the primary driver(s). CIPCO's affected units consist of Walter Scott Energy Center Units 3 and 4 (WSEC3 & WSEC4), and Louisa Generating Station (LGS). As noted in the table, these units are impacted by both air regulations and rules regarding land and water.

Table 10 – Environmental Abatement Actions

Abatement Equipment & Facilities	Mitigated Impact	CIPCO Coal-fired Unit			Air Regulations			Land & Water Regulations		
		WSEC3	WSEC4	LGS	CSAPR	MATS	NAAQS	CCR	ELG	316b
Scrubber (Spray Dryer)	Acid Gas (SO ₂ , Chlorine)	X	X	X	X	X	SO ₂			
Electrostatic Precipitator (ESP)	Particulate Matter	X	N/A ¹	X		X	Lead, PM			
Baghouse	Particulate Matter	X	X	X		X	Lead, PM			
Selective Catalytic Converter (SCR)	Nitrogen Oxides (NO _x)		X		X		NO _x , O ₃			
Low NO _x Combustion (LNB & OFA)	Nitrogen Oxides (NO _x)	X	X	X	X		NO _x , O ₃			
Activated Carbon Injection	Mercury	X	X	X		X				
Dry Bottom Ash Boiler	Combustion Residue	Planned	X	Planned				X	X	
Retired and/or Abated Wet Ash Impoundments	Combustion Residue	Planned	N/A ²	Planned				X	X	
New Dry Ash Monofills w/ Liner	Combustion Residue	Planned (Common)		Planned				X	X	
Wastewater Treatment Facilities	Wastewater/Runoff	Planned	X	Planned					X	
River Cooling Intake Modifications	Fish Entrainment	Planned	N/A ³	N/A ³						X

1- All units are able to fully comply with operating permits using only their respective baghouses. WSEC3 and LGS have retrofitted baghouses in addition to their original ESPs, which are still being operated to reduce baghouse O&M. WSEC4 was engineered to require only a baghouse for Particulate Matter (PM) control.

2- WSEC4 was designed & built with a dry bottom ash system and therefore does not contribute to the wet ash impoundment at the WSEC facility.

3- WSEC4 and LGS do not use once-through river cooling systems and instead use cooling towers.

There are many more regulations impacting the operations of CIPCO's affected units than are listed here. The regulations shown in the table represent some of the more impactful and recently updated or promulgated compliance requirements. The Cross-State Air Pollution Rule (CSAPR), Mercury and Air Toxics Standards (MATS) and National Ambient Air Quality Standards (NAAQS) comprise the Air Regulations. The Coal Combustion Residual Rule (CCR) regulates coal ash, Effluent Guidelines (ELG) control wastewater discharges, and 316b refers to that section of the Clean Water Act which is intended to reduce the number of fish and shellfish drawn in by coal plant cooling water intakes. These comprise the Land & Water Regulations.

Table 11 provides a detailed timeline of currently planned emission abatement projects, which actions CIPCO plans to take, and the affected unit(s). WSEC4 was constructed recently enough that many of the environmental regulations could be readily incorporated within the plant design. Currently, much of the environmental compliance activities there are related to maintenance and continuing operations of existing abatement equipment and facilities.

Table 11 – Budgeted Emission Abatement Projects

Budgeted Emission Abatement Projects		
<u>Plant</u>	<u>Year</u>	<u>Project</u>
Louisa	2017	Dry Ash Retrofit
	2017-2019	Ash Pond Retirement
	2017-2018	New CCR Landfill #1
	2023	New CCR Landfill #2
Walter Scott #4	2017	Catalyst Replacement
	2020	Catalyst Replacement
	2023	Catalyst Replacement
	2025	Catalyst Replacement
	2026	Catalyst Replacement
Walter Scott #3	2017-2018	Dry Bottom Ash - Conversion
	2017-2020	Ash Pond Retirement
	2017-2018	Scrubber Inverter - Replacement

CIPCO’s broad spectrum of residential, agricultural, and business energy-efficiency programs mitigates the need for energy supply and peak demand capacity from generation resources, eliminating a portion of the environmental impacts associated with burning fuels and constructing power infrastructure. Furthermore, CIPCO’s promotion of high-efficiency geothermal heat pumps also promotes a form of demand-side renewable energy. CIPCO continually monitors and evaluates emerging avenues for achieving further decreases of emissions, including smart grid explorations and related technologies.

CIPCO’s acquisition of wind, solar, and landfill gas power reduces its dependence on fossil fuels and the environmental impacts and risks associated with coal and natural gas generation. CIPCO’s planned investments in natural gas generation will help diversify its fuel supply and eliminate some environmental impacts on the air, soil, and water compared to coal-fired generation.

Looking forward, it remains important to be aware and knowledgeable of new and changing environmental regulations. Through the use of internal resources and external expertise, current and emerging environmental regulations will be evaluated for their potential effect on CIPCO’s business model. CIPCO’s overall response to new environmental regulations is not only an important strategic issue but also represents an important area of corporate responsibility that CIPCO takes seriously. One of the strategic priorities that serve to guide the organization is to maintain a commitment to carbon/emission-free power supply resources. This key focus informs future resource decisions by applying best practices in sustainable environmental stewardship.

CIPCO's financial forecast indicates that the monetary effect of future environmental regulations on CIPCO's business case is very manageable. CIPCO integrates three major components in its approach:

1. A relatively low emissions portfolio;
2. A strategic approach to planning; and
3. Demand-side management programs.

CIPCO's balanced energy portfolio and its array of demand-side management and energy-efficiency initiatives strengthen its ability to manage exposure to environmental regulations. Additionally, CIPCO's strategic approach to environmental issues has achieved success through its use of internal and external forecasts as well as market and regulatory intelligence. Continued attention to these priorities will allow CIPCO to best serve its consumer base while exercising both a high level of corporate social responsibility and good environmental stewardship.

Plan Meets Key Objectives

CIPCO's preferred resource plan meets several key objectives, including the provision of adequate, safe, and reliable service, maintaining competitive costs to consumers, minimizing environmental impacts and risks, and ultimately fulfilling CIPCO's mission as a consumer-owned utility.

Providing Adequate and Reliable Service

The addition of renewable power resources combined with the planned addition of complementary, regional generation resources in the mid-term of the planning horizon will meet the growing power needs of its member systems. In addition to its own resources, CIPCO will continue to make supplemental capacity and energy purchases to meet a modest portion of its resource requirements.

CIPCO's participation in MISO and its capacity reserve requirements will ensure that CIPCO maintains adequate supply resources on an ongoing basis. In addition, its participation in regional transmission planning, operations, and maintenance will help ensure reliable delivery of power to the end-use consumers on its system.

Maintaining Competitive Costs

CIPCO's combination of strong demand-side resource promotion, investment in additional low-cost renewable resources, and planned investments in gas-fired peaking and load-following resources reflect sound planning principles along with prudent management of fuel price and environmental risks. Available demand-side resource options and supply-side resources are evaluated on a consistent basis using CIPCO's avoided cost projections. This results in the implementation of a robust set of cost-effective DSM programs that are the foundation of CIPCO's resource strategy. Additional renewable energy acquisitions and power purchases reflect opportunities to further diversify CIPCO's resource portfolio while taking advantage of relatively low wholesale capacity and energy prices in the near term. Over the long-term, load growth, capacity retirements, and increasing wholesale power prices signal the need to select new resource additions to CIPCO's portfolio. However, the uncertainty of future wholesale power prices and load growth merit consideration of resources that maximize planning flexibility while minimizing financial risks and commitments.

Minimizing Environmental Impacts and Risks

CIPCO's continuation of its nuclear power investment, its sizeable acquisitions of wind and solar power, and its planned future investment in small increments of gas-fired generation reflect CIPCO's commitment to the environment and will reduce its carbon emissions over the course of this IRP planning horizon. As noted previously, approximately 60 percent of CIPCO's energy currently comes from carbon/emissions-free resources, and that share will remain relatively stable over the IRP horizon.

CIPCO's preferred resource plan greatly reduces its risks and potential compliance costs associated with:

- Greenhouse gas tax or cap & trade mechanisms
- Renewable or clean-energy portfolio standards
- Emissions controls capital and operating costs
- Emissions allowance costs
- Over-reliance on any one resource

Fulfilling CIPCO's Mission

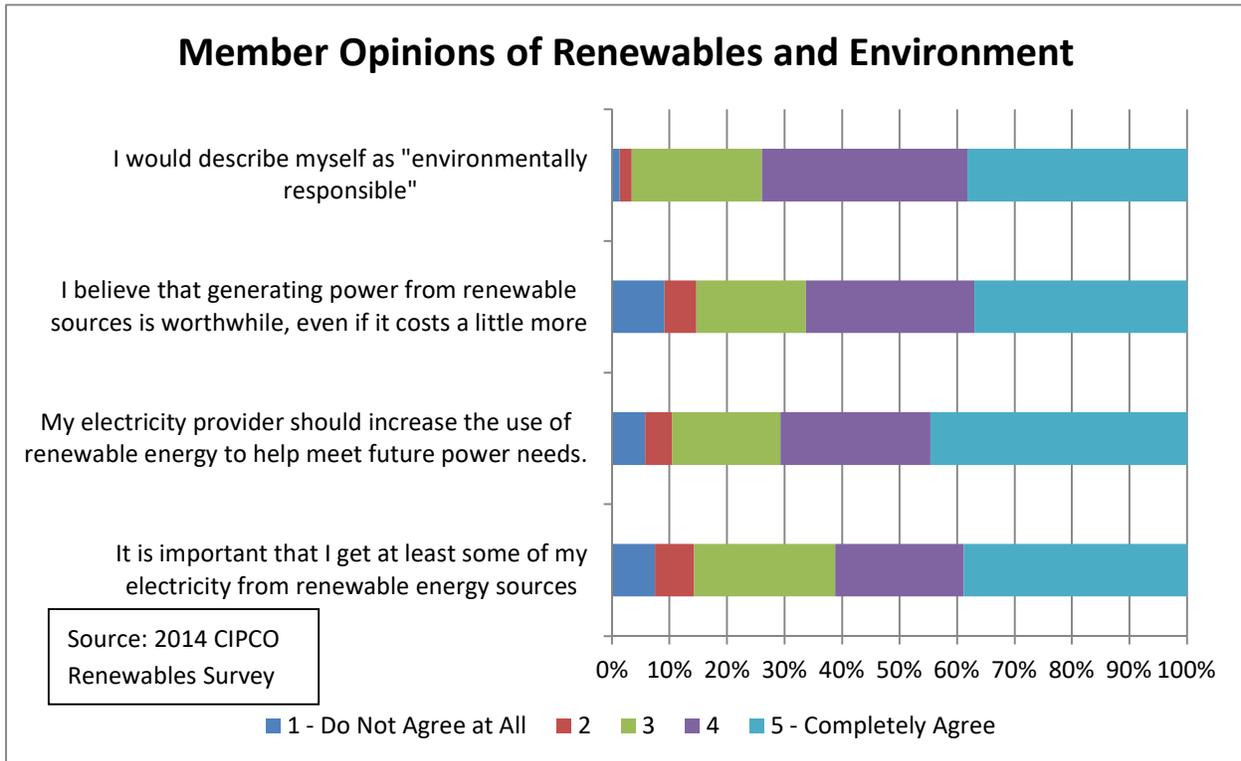
CIPCO's ultimate purpose is to create value for its member-systems through the production, packaging, and delivery of energy services. It accomplishes its mission through its key values of responsiveness to its members, sound judgment in its business operations and strategies, and collaboration to construct solutions that benefit its membership. The preferred plan is consistent with these core values and helps fulfill CIPCO's key purpose.

As a consumer-owned utility, CIPCO is responsive to the needs and desires of its member-systems. A 2014 survey of residential consumers on the CIPCO system indicates that:

- Members generally describe themselves as "environmentally responsible"
- Two-thirds believe that generating power from renewable resources is worthwhile, even if it costs a little more
- Most agree that their electricity provider should increase the use of renewable power
- More than 60 percent state that it is important to get at least some of their electricity from renewable energy resources

The results from those selected survey questions are illustrated in Figure 20.

Figure 20



The preferred resource plan is based on sound judgment using a prudent set of methodologies and analyses. The balanced approach to meet future needs represents a reasonable strategy that promotes energy efficiency and conservation, clean energy, and fuel diversity. The plan provides for adequate and reliable service to consumers on the CIPCO system, mitigates potential future risks to its power supply availability and fuel price volatility, and is consistent with the desires of its member-systems.

This plan is a collaborative effort involving input from CIPCO staff, the member managers and Board of Directors representing its member-systems, the general public, and third parties that have contributed information and analyses used in this report. Collaboration among these various parties has helped ensure that the preferred plan is prudent and will be beneficial to CIPCO's member-systems.

Uncertainty and Contingency Management

The CIPCO integrated resource plan analyses include a variety of assumptions and forecasts about future load growth, fuel and capital costs, environmental regulations, delivery of DSM measures, and other factors that are inherently uncertain. These assumptions help shape the actions recommended in the preferred resource plan. However, changes in key assumptions could result in changes to the preferred plan during the 15-year planning horizon. A set of possible changes to key assumptions are discussed in this section along with hypothetical reactions to those changes. This list of assumptions and subsequent plan changes is not exhaustive, but is intended to qualitatively evaluate a set of possible future outcomes that deviate from the base-case.

Load Growth Changes

Chapter 3 discussed CIPCO's most recent load forecast, which incorporated the impacts of CIPCO's DSM programs into the base-case forecast. The high and low economic growth and weather scenarios were also discussed, providing a range of plausible future load levels given different economic growth and weather drivers. Realization of these high or low scenarios will impact CIPCO's resource needs.

The base-case load forecast has an average annual energy growth rate of 1.3 percent over the 2017 to 2031 IRP horizon. By comparison, the slow economic growth scenario has a 0.5 percent growth rate and the rapid economic growth scenario has a 2.2 percent annual growth rate over the IRP horizon. These growth rates incorporate substantial uncertainty regarding long-term economic growth and assumed load levels for a handful of very large energy users within the CIPCO system.

Faster-than-expected load growth would result in additional resource needs over a shorter time period. This would likely result in additional wholesale market purchases in the short term, more aggressive promotion of DSM programs, and a faster and/or larger deployment of gas-fired generation. If more rapid growth is expected to be sustained over the long term, CIPCO may consider participating in a larger, central station gas-fired power plant or other resources, should those options be available.

Slower-than-expected load growth could result in lower wholesale market purchases or additional market sales in the short term. In the medium-to-long term, slow load growth could merit some delay or deferment of the planned additions of wind power purchases and gas-fired power generation. It is anticipated that slower-than-expected load growth across the region would lead to lower wholesale power market prices and provide CIPCO the opportunity to extend the time frame over which it purchases a larger amount of wholesale power rather than investing in new generation assets.

Fuel Price Level Changes

The preferred plan relies on a set of assumptions regarding fuel prices. Given the current fuel price forecasts, the preferred plan calls for the addition of gas-fired generation resources beginning in 2020 in addition to CIPCO's planned wind and solar power investments.

Higher natural gas prices may cause CIPCO to alter its fuel-choice strategy for new resource investment over the planning horizon. Any changes in the fuel type of new generation will also be influenced by factors such as the availability of new resources in CIPCO's region, expectations for future environmental regulations, and other risks associated with generation fuel or equipment types.

Additionally, substantial increases in fuel costs will increase CIPCO's avoided cost and will increase the amount of cost-effective DSM and may increase renewable load-side generation available on the CIPCO system. This may partially mitigate the need for, or defer, new resource investments beyond those currently anticipated in the preferred plan. This is also true of any substantial increases in the capital cost of new generation.

Environmental Regulation Changes

The preferred plan incorporates current and expected future regulatory changes with regard to air, water, and soil pollution and emissions. However, future environmental regulations and enforcement always include some element of uncertainty. Anticipated and proposed regulations can be deferred or even eliminated through legal action or changes in policies. Likewise, environmental regulations tend to become more strict over time, and new regulations are likely to be enacted over the 15-year planning horizon that are not currently anticipated.

CIPCO believes that its preferred plan mitigates much of the potential risk associated with future environmental regulations. Its significant acquisitions of wind and solar energy and modest investment in future gas-fired generation limit its exposure to more strict environmental regulations. Overall, CIPCO's supply portfolio is well positioned to effectively deal with both present and proposed environmental requirements as well as potential risks centered on CIPCO's nuclear investment.

Although the preferred plan is very well positioned to withstand risks from new regulations, CIPCO retains the flexibility to increase the amount of DSM offered to consumers on its system, increase future acquisitions of renewable energy, modify its investment in gas-fired generation, reduce the amount of coal generation, or a combination of these options.

DSM Changes

CIPCO's strong commitment to demand-side management and its broad experience implementing DSM programs provide CIPCO with a solid foundation to meet its DSM objectives as outlined in the preferred plan. However, any substantial changes in consumer acceptance of DSM measures, delivery of DSM products and programs, alternate fuel prices, CIPCO's avoided costs, technology advances, or regulatory changes, such as new appliance efficiency standards or building codes, may require CIPCO to alter its planned investment in DSM activities.

Increases in CIPCO's avoided costs above what is currently anticipated in the preferred plan will allow CIPCO to increase its investment in cost-effective DSM programs, and may also support increased load-side generation. Furthermore, cost reductions of major DSM equipment or the introduction of new cost-effective technologies may also allow CIPCO to increase its cost-effective DSM offerings.

Conversely, any unforeseen difficulty delivering the magnitude of DSM savings expected in the preferred plan may cause CIPCO's DSM impacts to fall below what is expected in the preferred plan. In addition, measures where fuel choices are available, such as heat pumps, may also be impacted by the price of alternate fuels, primarily propane and natural gas. Steep declines in those fuel prices may reduce the consumer's motivation for switching to electricity as a fuel, despite the potential for overall energy-efficiency improvements. In addition, the expiration of the federal tax credit for geothermal heat pumps in December 2016 may significantly decrease the demand for those systems and cause consumers to choose non-electric heating fuels or electric resistance systems, along with less-efficient central air conditioning systems. The impacts of the tax credit expiration and the potential for renewal of this tax credit are uncertain at this time.

Chapter 7: Action Plan

Action Items

CIPCO files an updated integrated resource plan with WAPA every five years. This chapter highlights a list of action items intended to be accomplished between now and CIPCO's next anticipated IRP filing.

The preferred plan lays out the key resource outcomes of the IRP process and the timing for implementing those actions. This chapter details the actions that CIPCO intends to take ***over the next five years (2017 to 2021)*** as part of implementing this IRP's preferred resource plan.

- Continue to offer the DSM programs discussed in the preferred resource plans. Continue to evaluate new measures, measure costs, delivery mechanisms, and promotional avenues to meet or exceed the DSM goals presented in this IRP. The energy-efficiency programs included in the preferred resource plan are estimated to reduce summer peak demand by approximately 25 MW in 2021.
- Monitor any potential renewal of the geothermal heat pump tax credit and the potential impacts of non-renewal on DSM program impacts and load growth. This should be evaluated and incorporated into CIPCO's DSM participation updates and 2017 long-term load forecast.
- Comprehensively re-assess the current portfolio of DSM programs and potential new measures and programs in 2019 as part of a new DSM program assessment and five-year DSM plan.
- Continue to explore additional opportunities in demand-response programs that aim to reduce energy use, reduce peak demand, and/or shift on-peak energy use to off-peak periods. Although these activities are ongoing, new opportunities should be identified as part of the 2019 DSM evaluation and five-year plan update, incorporating CIPCO's avoided costs at that time.
- Continue to acquire carbon-free power resources including the planned solar power resource addition in 2017 and wind power resources to be added in 2019. Continue to monitor prices for wind and solar power and evaluate additional opportunities to add renewable power while diversifying CIPCO's resource portfolio, maintaining stable future power costs, and mitigating environmental risks.
- Monitor the potential of SIMECA and other municipalities' future diesel unit changes and any deviations in municipal generation from the expectations presented in this IRP.
- Continue to monitor load growth trends and load forecast trajectories to help determine the magnitude and timing of adding small gas-fired generation, and any deviations from the expectations presented in this IRP (first addition planned to be on-line by 2020).
- Continue to invest in emissions abatement technologies and processes where they are cost-effective and consistent with CIPCO's resource and environmental strategies. CIPCO's budgeted amount of capital investment in abatement technologies over the 2017 to 2021 period is approximately \$16.6 million, as discussed in Chapter 6.

- Continue to meet RUS guidelines of no more than one hour of outage per consumer per year through improved infrastructure, communications technologies, and maintenance activities associated with transmission and distribution systems. This metric is measured monthly and is evaluated on at least an annual basis.
- Continue to participate in regional transmission organizations that promote increased reliability, increased access to low-cost and renewable power resources, transmission system maintenance and improvements, and open access to transmission resources. These are ongoing efforts.
- Continue to monitor and evaluate CIPCO's regulatory compliance and government relations regarding state and federal environmental laws, including its participation in the Iowa Environmental Group. These are ongoing efforts.
- Monitor developments that may impact the preferred plan implementation and adjust plans as necessary to meet the goals outlined in this IRP. These are ongoing efforts, and are formalized in CIPCO's annual budget and financial forecast updates.

Measurement and Verification

CIPCO's resource assessment process provides a menu of options to meet the needs of its member systems while controlling costs, maintaining or improving reliability, managing price and environmental risks, and minimizing adverse environmental impacts. The preferred plan outlined in this report should be considered the baseline upon which the IRP action items will be evaluated. Measurement and verification of the actions listed in the previous section will be ongoing, with key milestones as noted in the IRP Action Plan.

CIPCO's DSM programs are evaluated to determine the achievable market potential, cost-effectiveness, consumer impacts, and overall impact on CIPCO's resource needs. CIPCO's current DSM plan includes measurement and verification processes for program performance. The impacts of active DSM programs will continue to be measured by actual participation rates and the associated energy and demand impacts, based on actual measured or typical equipment performance variables, available consumer choices without a program in place, and likelihood that the consumer would choose any one alternative. CIPCO's next DSM assessment will cover the 2020 to 2024 period and is expected to be evaluated and completed in 2019. At that time, modifications will likely be made to existing programs and additional programs or measures could be added.

The timing and magnitude of new supply-side resources may be impacted by changes in the load forecast, capital or fuel prices, regulatory requirements, or other items. Potential new resources are compared to financial forecast assumptions and results, and are integrated into the succeeding financial forecast update after they have been selected for implementation. The IRP Action Plan includes anticipated dates for specific actions, along with estimated capacity and energy impacts of each item.

As discussed previously, CIPCO maintains the RUS goal of a maximum of one hour of outage per consumer per year. CIPCO monitors its performance monthly and evaluates its performance at least annually.

Chapter 8: Member and Public Input

CIPCO values public participation in its resource planning efforts to help guide its resource decisions and to best meet the needs of its member systems. Its member systems are involved in the resource planning process and provide input regarding the selection of resources. Where the impacts of resource planning go beyond the membership of its systems, CIPCO seeks participation from the general public through information communications, public meetings and forums, through third party organizations, and through established regulatory processes.

This chapter summarizes key elements of the member and public input for the CIPCO system. Specific meeting dates and agendas are available to WAPA upon request.

Member-System Input

CIPCO is a consumer-owned utility, comprised of 12 rural electric distribution cooperatives that are owned by their 118,000 member-owners, and SIMECA's 15 community-owned municipal utilities. CIPCO's consumer-owned member systems provide input to CIPCO's strategic direction through participation in Board and management meetings. Each of CIPCO's member systems is, in turn, owned by their consumers who provide input and direction to their systems either directly or through elected or appointed representatives. In this manner, a broad population has direct or indirect input into CIPCO's decisions and strategic direction.

CIPCO conducts a survey of residential consumers every three years to assess changes in appliance holdings, adoption of energy-efficiency measures, and consumers' fuel choice preferences. This information, collected from 4,000 to 5,000 residential consumers, helps guide CIPCO's load forecasting and DSM planning processes which are direct inputs into the IRP analyses. In addition, CIPCO regularly conducts member opinion surveys regarding energy efficiency, the environment, and energy policy. Selected data collected in the end-use and opinion surveys were presented in this report.

CIPCO works closely with its member systems in the evaluation, selection, and implementation of demand-side resources. Since CIPCO does not directly serve any retail consumers, coordination with its member systems regarding DSM implementation and delivery is critical to achieve successful results and meet demand-side resource goals. CIPCO's member systems provide input into demand-side planning and are actively involved in its implementation and success. DSM-related activities of CIPCO and its member systems are discussed in depth at quarterly member service meetings. High-level discussions take place, as necessary, at quarterly manager meetings and monthly CIPCO Board meetings. During planning years, additional meetings and teleconferences take place with CIPCO and its member systems.

CIPCO's Board of Directors is actively involved in CIPCO's overall financial planning process, the selection of supply-side resources, and any material changes to existing resources. Major investments and changes in both demand-side and supply-side strategies are approved by CIPCO's Board. CIPCO's Board of Directors, representing its member-systems, has approved this Integrated Resource Plan as documented in Chapter 9 of this report.

CIPCO Member Cooperatives and Local Contractors - Momentum Is Building

Momentum Is Building (MIB) is an annual energy-efficient home building conference sponsored by Iowa's electric cooperatives. MIB offers an opportunity to gain insight into new techniques from nationally known speakers, see the latest building products offered by vendors and network with other building, electric and HVAC professionals. Support for the conference comes from Iowa's rural electric cooperatives and a grant from the Iowa Energy Center.

Momentum Is Building offers up-to-date building science information, practical hands-on information and new technology displays for building trades professionals – including homebuilders, electricians and heating/plumbing contractors. Rural electric cooperative personnel from across the state also attend.

Nationally-recognized speakers share their knowledge on topics including trends and commonly asked questions in energy-efficient building, equipment (e.g., lighting, ventilation systems, plumbing systems) and a number of trade-specific regulations (e.g., the Uniform Plumbing Code, International Mechanical Code, National Electrical Code, and International Energy Efficiency Code). Several sessions offer Continuing Education Units (CEU) that are required for licensing in the electrical, mechanical and plumbing disciplines.

MIB is celebrating 25 years in 2017. More information including past conference agendas can be found at <http://www.momentumisbuilding.com/>.

General Public Input

Although CIPCO's ownership structure allows for direct and indirect input from its member systems, some resource decisions by CIPCO impact the general public beyond its ownership. This is especially true of new generation and transmission resource planning and development but can also be true for public outreach regarding electric safety, energy efficiency, and economic development.

CIPCO and/or its agents (including partners in the construction, ownership and operation of jointly-owned power plants and transmission facilities) have and will continue to seek and provide opportunities for direct public participation as new supply-side resources are planned, proposed and move through the necessary jurisdictional approval processes. This is true of the new generation resources included in the Preferred Plan.

CIPCO and any partners involved in development of new generation or transmission infrastructure impacting the general public will engage the public through information dissemination, public meetings and forums, regulatory processes, and other avenues that are typically available as part of resource development. These public input opportunities will gather and share public information, seek to identify key concerns of the public, and respond to those comments and concerns. Some of these activities will be coordinated directly by CIPCO, while others will involve project partners, regional planning organizations, or regulatory bodies at the state or county level.

Chapter 9: Approval

The 2017 Integrated Resource Plan herein was reviewed by CIPCO's member system managers and approved by its Board of Directors. The Board resolution approving this IRP, dated March 28, 2017, is included on the following page.

CERTIFICATE

I, Allen Albers, do hereby certify:

That I am the duly elected, qualified and acting Secretary-Treasurer of CENTRAL IOWA POWER COOPERATIVE (hereinafter called the "Cooperative") and the keeper of its records; that at a regular meeting of the Board of Directors of the Cooperative with a quorum of directors present in person, held March 28, 2017, the following resolution was adopted:

WHEREAS, the Energy Policy Act of 1992, Public Law 102-486 Section 114, Title II- Integrated Resource Planning required by the Department of Energy to develop, promulgate, and enforce rules requiring Power Marketing Authorities to implement integrated resource planning; and,

WHEREAS, Department of Energy, 10 C.F.R. Part 905, Energy Planning and Management Program rules require Power Marketing Authority (hereinafter PMA) customers to file Integrated Resource Plans; and,

WHEREAS, the Western Area Power Administration (hereinafter WAPA) is a PMA; and,

WHEREAS, the Cooperative is a WAPA customer, and must comply with these rules; and,

WHEREAS, this Member-Based Association (hereinafter MBA) filing by Cooperative represents the collective interests of the individual member utilities it serves including: Clarke Electric Cooperative, Inc.; Consumers Energy; East-Central Iowa Rural Electric Cooperative; Eastern Iowa Light and Power Cooperative; Farmers Electric Cooperative, Inc.; Guthrie County Rural Electric Cooperative Association; Linn County Rural Electric Cooperative; Maquoketa Valley Electric Cooperative; Midland Power Cooperative; Pella Cooperative Electric Association; South Iowa Municipal Electric Cooperative Association (SIMECA) representing the Iowa municipals of Bellevue, Brooklyn, Cascade, Corning, Durant, Earlville, Fontanelle, Gowrie, Greenfield, Lamoni, Lenox, Orient, Stuart, Villisca, and Winterset; Southwest Iowa Rural Electric Cooperative; and T.L.P. Rural Electric Cooperative.

NOW THEREFORE BE IT RESOLVED, that the Cooperative approve the WAPA IRP Report dated March 28, 2017; and,

BE IT FURTHER RESOLVED, that the Cooperative file the WAPA IRP Report with WAPA as an MBA.

That said resolution has not been amended, altered, rescinded or modified, and is presently in full force and effect.

IN WITNESS WHEREOF, I have executed this certificate and attached a corporate seal of the Cooperative this 28th day of March A.D, 2017.


Secretary-Treasurer

(CORPORATE SEAL)